



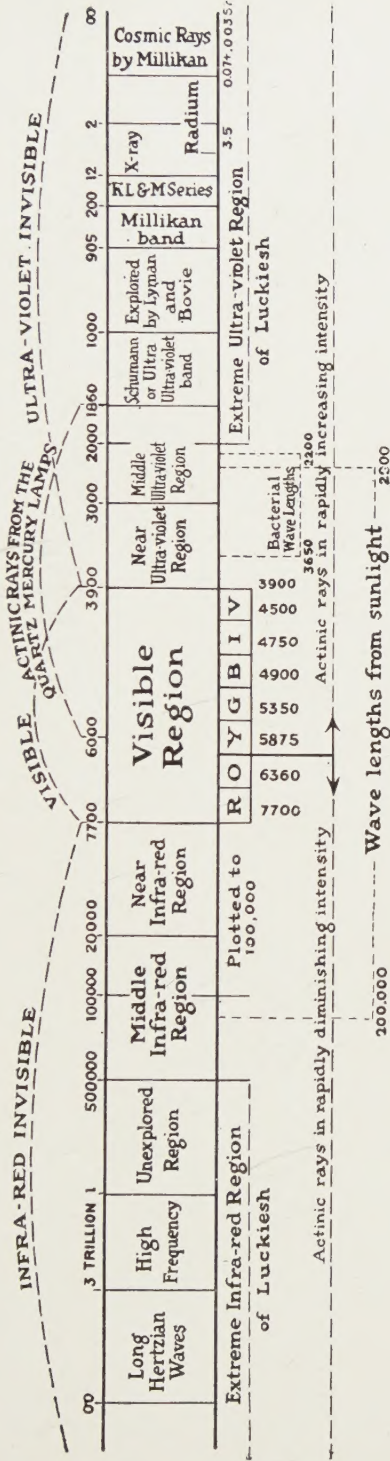
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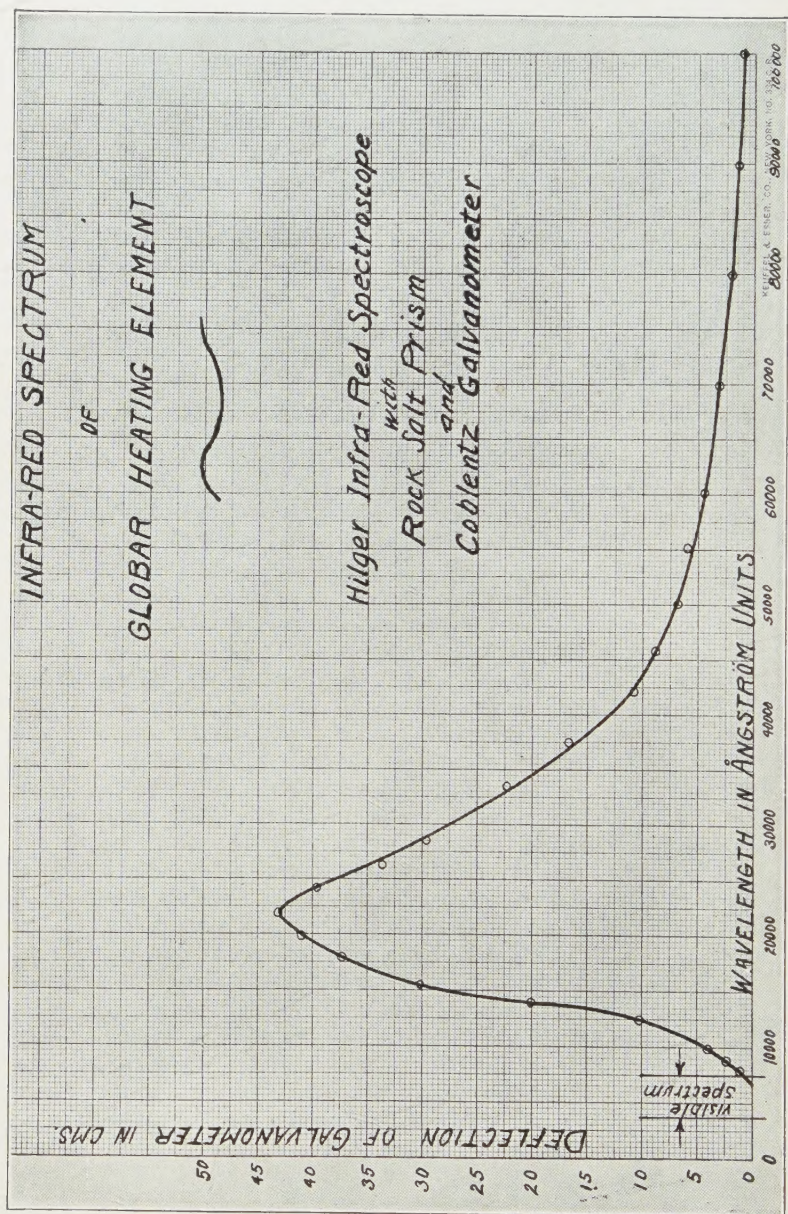
DIAGRAMMATIC SPECTRUM ANALYSIS



SCALE IN (Å) ANGSTRÖM UNITS



Diagnostic Spectrum Analysis
Plate I



Infra-red spectrum, reproduced by courtesy of James Barnes, Ph.D.

Actinotherapy and Allied Physical Therapy

T. HOWARD PLANK, M. D.



WITH ILLUSTRATIONS



*This book is dedicated to
my mother, whose life has
been an ever-present in-
spiration to me.*

THE AUTHOR.

FORECAST

This book has been written in the hope that it may in some small measure be an aid and a guide to practitioners of medicine who are interested in physical therapeutics, and as a means of awakening those who are not.

Physical measures are being taken up so rapidly by the profession that it has seemed wise to add everything in the line of physical therapy that I have been doing for many years past. The hope I have expressed in the past that the medical profession would take a more active interest in physical therapy is rapidly coming to pass and this is exceedingly gratifying to those of us who have been working in this field for many years.

One of the handicaps of physical therapy in the past has been that it was thought to encroach upon the various specialties. Yet this very fact should aid in its recognition for there is not a specialty in the practice of medicine which cannot use some physical agent to advantage.

The prescribing of physical remedies to diseased conditions should not be left in the hands of technicians. They have not the necessary knowledge of pathology or the pathological changes taking place in the various tissues to make them efficient in the work therefore it is necessary for the physician with his knowledge of pathology to acquire an equal knowledge of the physics and the therapeutic application of physical measures. He will then be in a position to administer or prescribe the treatment necessary for the individual case, and he should supervise every treatment given for only in this way can the various changes taking place during the course of a diseased process be anticipated and the necessary orders for changes in technique be given.

The following books are recommended and should be used for study as well as reference:

Neoplastic Diseases. *Ewing.*

Text Book of Pathology. *MacCallum.*

Chemical Pathology. *Wells.*

Principles of General Physiology. *Bayliss.*

Text Book of Physiology. *Howell.*

Differential Diagnosis. *Fussell.*

Introduction of Biophysics. *Burns.*

Diagnostic Methods, 7th Edition. *Webster.*

The Newer Knowledge of Nutrition, 3rd Edition. *McCollum.*

Blood-work, Parasitology, 7th Edition. *Stitt.*

Practical Hydrotherapy. *Pope.*

Modern Hydrotherapy. *Secor.*

Text Book on Massage, 2nd Edition. *Despard.*

Massage, Its Principles and Technique. *Bohm and Painter.*

Mechanical Vibration and Therapeutic Application. *Snow.*

Static Electricity. *Snow.*

It is not always advisable and certainly not always necessary that one starting in physical therapy should add all of the apparatus at one time. It is much better if only the apparatus needed for the work one has been doing is added first, other equipment to be purchased as needed.

Physicians should be and are leaders in investigating agents beneficial to the public health and they are now becoming leaders in the use of physical therapy. It will not be long until all of the State Universities will have data on the physics of the various equipment now in use, and if you are in doubt regarding the fundamentals of your apparatus write the physics department of your State University and you will be surprised at the amount of assistance you will be able to obtain for the asking. What is better, take a few days off and visit the physics or other departments of your State University. It will be not only a pleasant vacation but a post-graduate course as well.

The American Medical Association has a committee on the standardization of physical-therapy apparatus and they will gladly give you information on the physical-therapeutic equipment offered for sale.

The future of physical therapy is now assured and it is up to those of us who are using it to put it upon as scientific a basis as possible. This will give physical therapy and its users the needed recognition and more we cannot demand. The public are with the practitioners of medicine; all they ask is that we do our best for them. They do not expect miracles and if we will take them into our confidence explaining what can and cannot be done in their particular condition, we will have no trouble getting their complete co-operation. Regardless of our knowledge or equipment, we cannot get satisfactory results without the patients' co-operation.

PREFACE

There is a definite demand for detailed information along the lines of actinotherapy and allied physical therapy.

This book has been written and arranged from a practical rather than a theoretical standpoint. An effort has been made to give only the practical side of the practice of medicine, so I have endeavored to eliminate the superfluous and the discarded methods of the past. Without these discarded methods, we would not be where we are today. They have served us well and we must consider them as foundation stones, yet I cannot think that it is necessary to carry them along from generation to generation in an effort to bring the past up to the present. Discarded methods, which were extremely valuable in their day, may be found in the archives where they should be retained for the student and the investigator. The practitioner of medicine in active practice has little spare time to browse. He needs something he can turn to and get definite information to use for the case at hand. Immediate consultation is the thing demanded.

In the following pages, it has been my endeavor to put the essentials of the diagnosis and treatment of the various diseases given into a compact form for ready reference. If details are sought, they are readily found in the text books and encyclopedias. No effort has been made to make this book complete either as to the number of diseases, their subject matter, or their treatment, but as stated above, I have tried to give the essentials in readable form for ready reference of those diseases which I have treated with the various methods of actinotherapy and allied physical therapy. Of these methods, I have given only those which I have found of value or, I might put it, most valuable and an effort has been made to place the different methods in the order in which they have been found most useful.

To the practitioner of medicine who is without the apparatus referred to, this book may be a disappointment, but for these reference will have to be made to other and in some instances older works many of which are extremely valuable and are still referred to by the author.

To have included all diseases even where the modalities given were applicable, would have taken the author into unknown fields and I have preferred to leave those fields open to those more competent to cover them. On the other hand, to have included all forms of apparatus for the treatment of the different diseases given would have made the work too bulky and this would have lessened its practicability.

Derision of any method of treatment has been studiously avoided for the author uses any and every method which has been

found of value in conjunction with actinotherapy and its allied physical therapy and wishes to make this plain and distinctly understood. No one method has ever been nor will it ever be sufficient to cover all diseases nor all cases of any one disease and anyone who tries to make one method cover all cases is rightly called a cultist.

Naturally all practitioners of medicine would welcome specifics but they have not been found and probably never will be, for even individual diseases vary so much in the different cases and the complications in each case may be so many and varied that every thing of value in each department of medicine must be retained and used when required, but I have believed for years and am now much more convinced that in the various physical methods we have measures superior in many cases to drugs.

Many of the afflictions of humanity are mechanical as acute suppression of urine, some are dietetic deficiencies as scurvy and rickets, most diseases are toxemias or infections, usually a mixture of both, some are traumatic and here nature requires rest of the part to enable the repair processes to go on uninterruptedly for motion may break down the repair work faster than it can be built up. We are constantly dealing with a variety of mentalities influenced by a greater variety of environmental conditions so that in toto the practice of medicine is a vast complex syndrome which we may not hope to entirely unravel.

It is not given for any one of us to say which is the best method, for the best today may be very inferior tomorrow. We live in a world of constant change. The alchemists staked their all on their ability to transmute elements, evidently from an instinctive knowledge that transmutation was a possibility. Although mankind has so far failed in his efforts along this line, we now find that natural transmutation is an actuality as in the radio-active substances from uranium to lead. Here transmutation stages run from a millionth of a second up to billions of years for each separate stage and it is the dream of present day scientists that all elements are in a very slow transmutation stage.

With all this known state of change, can we as practitioners of medicine even hope to attain the ultimate in relief? We can and should use to the best of our ability such things as are collectively worked out, for the benefit of our fellow man, and that is all that is in the mind of the author regarding the treatments given in the following pages. The individual life and mind have too short a range to hope to accomplish much alone, but with the aid of the past and the best possible use of the present we should hope to pass something on to the future generations that will be as much to their benefit as that which the immediate past generations have passed on to us.

T. HOWARD PLANK.

Chicago, Illinois, June, 1926.

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CHAPTER I

Wave Lengths.

Although Luckiesh gives a good general description of the spectrum by dividing it into three very unequal parts: the ultra-violet, visible, and infra-red, two of which (the ultra-violet and infra-red) he redivides into near, middle, and extreme, they are indefinite from the point of production and I believe it would be better if we would always talk in Angström units. This would at least have the advantage of definiteness.

The extreme ultra-violet is from 00 to 2000 Angström units, the middle from 2000 to 3000, and the near ultra-violet from 3000 to 3900 Angström units. Then comes the visible from 3900 to 7700 Angström units, followed by the near infra-red from 7700 to 20000, the middle from 20000 to 500000, and the extreme infra-red from 500000 to 00. These do very well from the spectral side of the subject but leave us sailing in free space from the productive side, for we have no means of producing wave lengths comparable with these divisions.

The present apparatus overlaps these divisions at one or both ends. Starting with the shortest wave lengths, the radium gamma rays have been measured to .07 of one Angström unit while the longest alpha rays from the radium are about 3.5 Angström units in length. Millikan has discovered what he believes to be a new ray which is at least fifty times shorter than the shortest gamma ray of radium which he calls the Cosmic ray. From here we step to the roentgen rays which vary from 12 to .5 of one Angström unit for the rays which are being used today though the softer longer wave lengths from 8 to 200 Angström units have been plotted. So we see that already two methods of producing wave lengths have been disposed of and we still have from 200 to 1860 Angström units, the upper end of the extreme ultra-violet division, all of which has been plotted, but we have no method of producing these rays which would make them available for use in the actual practice of medicine. The present method of producing these wave lengths is with a spark gap placed in a vacuum, and their transmission through fluorspar.

Starting at 1860 Angström units, we are making very valuable use of the wave lengths of the middle ultra-violet region which takes us to 3000 Angström units. These are produced by the quartz mercury-vapor and carbon-arc lamps but these lamps also produce the near ultra-violet from 3000 to 3900 so it is impossible to call either of these spectral divisions after the lamp which produces, not only these two essential divisions, the middle

and the near ultra-violet, but a large portion of the visible spectrum as well with a wide line in the near infra-red at 10140 and a few lines up to 14000 Angström units.

Our present tungsten bulbs give us wave lengths from 3900 to about 7000 Angström units, while the carbon filaments give wave lengths through the visible spectrum into the near infra-red region. Again we cannot name the region after the apparatus producing it as no known apparatus of the present time confines its wave lengths to any one region. We have wave lengths from the sun from 2900 Angström units in the ultra-violet region to an undefined portion in the infra-red region.

Leaving the visible spectrum at 7700, we pass on to the invisible infra-red frequencies. To produce these wave lengths we are obliged to use lower temperatures, some of which give a few lines in the visible region, mostly in the orange and red regions, then we pass into the invisible infra-red or heat frequencies. It is a well known law in physics that the higher the temperature the shorter the wave lengths and in carrying out this law, we find that radium gives the shortest known wave length, for to physicists, radium is the greatest heat-producing element known in the universe.

Most of the apparatus for producing near infra-red frequencies, which is on the market today, carries us just short of or slightly over the middle infra-red region, i. e. just above and below 20000 Angström units, Luckiesh's dividing line. The wave lengths from some of the present day infra-red apparatus have been plotted to around 100000 Angström units. Abney was able to photograph the infra-red region up to 27000 Angström units with a special bromo-silver emulsion which he personally prepared, thus proving that the infra-red frequencies have chemical action, although in decreasing intensity as the wave lengths grow longer. The carbon-arc lamps give a range from 2300 to 32000 Angström units.

Leaving the near infra-red frequencies we pass a long way up the spectral scale to the wave lengths which produce the greatest constructive heat used in medicine today or those wave lengths which are produced by what we now call high-frequency machines. These oscillations now range from about one to three million, giving wave lengths from one to three trillion, all in the extreme infra-red region of Luckiesh.

The more rapid the oscillations, the greater the surface dispersion, hence the greater the surface heating and conversely less heat is developed in the deeper tissues unless high voltage is used.

These wave lengths can be driven through any part of the human body without destruction of normal tissues provided the temperature is not raised above 125° F. for long periods of time. Here again we have a long space from around 100000 Angström

units up to a trillion Angström units which is not definitely plotted and for which we have no method of producing at the present time and probably could not use them even if we could produce them.

From present clinical experiences as well as from present scientific data, the best oscillation frequency is apparently around 1,500,000, which will produce a wave length around three trillion Angström units.

Having discussed the various wave lengths used today by the medical profession, it is well worth our time to study the action of the wave lengths used. Beginning with the shortest, those produced by radium, we find that a very small quantity of these for a very short time is stimulating to the cell life of human tissue. An average stimulating dose would be from 50 to 100 milligrams of radium sulphate screened with a half millimeter of brass, one millimeter of lead, two centimeters of wood or leather, and one millimeter of rubber for one-half to one hour which would be short of a skin-erythema dose. This screening would eliminate both alpha and beta rays, using only the very short gamma rays, which are not deflected by any known substance though the longer gamma rays are absorbed in varying degrees by various elements. The destructive time for this quantity and screening would be from eight to twenty-four hours.

The roentgen rays also have a stimulating or, as it is usually called, an ionizing action in small doses for short periods of time, but when the time element in treatment is increased, their action is also destructive.

Leaving the roentgen rays at 8 or 12 Angström units, we pass by the wave lengths up to about 2000, as the intervening lengths are not available for use in medical practice. The frequencies from 12 to 200 are known as the K, L, and M series of roentgen rays, from 200 to 905 as the Millikan band, from 905 to 1000 as the Bovie band, and from 1000 to 1860 as the Schumann band.

From 1860 or in round numbers from 2000 to 6000 Angström units, we have the wave lengths produced by the quartz mercury-vapor lamps. The carbon-arc lamps produce wave lengths from 2300 to 32000 Angström units. While certain regions within this range of wave lengths (2000 to 6000) produce definite effects, many of which are definitely catalytic, the human body cells demand all of these frequencies in varying degrees for the production of what we choose to call good health. While the wave lengths around the 2550 line are mostly bactericidal, it is common knowledge that those coming from the sun which never reach the earth shorter than 2900 are nevertheless bactericidal. Coblenz has proved that wave lengths up to 3650 Angström units are bactericidal if sufficient time (three to six hours) is allowed. Professor Steenbock of the University of Wisconsin uses the wave lengths

between 2950 and 3250 for the activation of foods against rickets. But neither of these statements argues in the least for treatment by definite wave lengths, but rather for wave lengths which include these, 2950 to 3250 Angström units.

Betz gave himself an intravenous injection of 0.2 gms. of hematoporphyrin and immediately found himself extremely hypersensitive to sunlight or wave lengths from 7700 to 3900 Angström units.

The wave lengths close to the ones desired for a specific effect are not only non-destructive for average exposures but are decidedly beneficial. Coupled with the above statements, I may add that we have no screen at this time which will remove any surrounding wave lengths even if it were desirable. Present screens remove only a portion of each line. The fainter lines naturally disappear first but by increasing the time the fainter lines are allowed to make their appearance on the film as though they had not been screened out. For example, given a light source with and without screening, all wave lengths from the light source would instantaneously affect a photographic film if unscreened. If screened, most lines would be cut out if the exposure was 1/1000 of a second, more lines would be seen in 1/100 of a second, still more in 1 second and still more in 10 seconds and so on.

Some ten years ago I gave up the use of the cobalt blue filters because it took from one to two hours to produce the same result that could be obtained in three or four minutes with the quartz mercury-vapor burner unscreened. This effect produced by screening has been verified by both Professor Gale of the University of Chicago and Professor Steenbock of the University of Wisconsin.

As far as present knowledge goes, healthy human cells are absolutely dependent upon all wave lengths between 2900 and 8000 Angström units and are benefited by wave lengths both longer and shorter than these extremes if given in limited quantities, and it is to the defining of these limited quantities that many scientific men are today devoting their energies.

The sun gives us wave lengths from 2900 Angström units up through the visible spectrum into the near infra-red region and treatments by wave lengths from the sun we know as heliotherapy, therefore heliotherapy does not give us wave lengths from any definite division but includes all of the visible spectrum dipping well into the ultra-violet and up into the infra-red. Its use, however, is almost universal as all animate beings are dependent upon the various wave lengths of the sun which reach the earth's surface for their very existence. Heliotherapy in moderate, regulated doses is metabolic, acting as an alterant and reconstructant. Acidosis is decreased due to the rapid increase of the alkaline properties of the blood stream. Chlorophyl absorption of sun's

rays is greatest between 6500 and 6660 with some absorption at 6780 Angström units, slight between 4800 and 4000.

Passing now to the heat wave lengths from 6000 upward, we find a few in the orange and red visible frequencies but more of them in the various infra-red regions.

Steinmetz stated, "Where intense radiation is intercepted by a body, chemical action may result from the heat energy into which the radiation is converted. The action of the infra-red radiation on plant life seems to be a chemical action and this would be the most important of all chemical actions as upon it depends the life of all vegetation and hence of animal life and thus of our lives."

As infra-red rays are absorbed, they produce heat at the point of absorption and this mild hyperemia is of value as a sedative because of its action in relieving stasis. Thus we see that the long, slow infra-red frequencies have their use physiologically in biology and if this be true then they are of definite value therapeutically in restoring pathological conditions to normal.

The infra-red, red, orange, and yellow wave lengths have no perceptible action on bacteria, while the wave lengths from the blue down through the middle ultra-violet either injure or destroy them. Again in the Schumann band and beyond through to the shortest radium-gamma frequencies, there is very little if any direct bactericidal action so far as known at this time. These wave lengths are of such a nature that they are absorbed by the body cells in varying degrees which in turn varies the depth of penetration of the different wave lengths for it is obvious that a wave when absorbed cannot penetrate beyond that point.

What we know as high-frequency currents giving wave lengths of from one to three trillion Angström units in the extreme infra-red region carry heat to any desired part of the body. These wave lengths can be used for long periods of time without destructive action unless a very high temperature is developed and maintained. Furthermore these frequencies are decidedly restorative to cells of sub-normal activity. The heat produced by these wave lengths is with very little doubt produced by the infra-red frequencies in the extreme infra-red region of Luckiesh. They do not produce electrolysis because the current producing them is alternating, thus any electrolytic action of one oscillation is neutralized by the next one thus rendering the current harmless from the point of electrolysis.

The wave lengths given above are from the clinical side regarding their practical use rather than the scientific, as no two scientists agree on the absolute wave lengths produced by the various apparatus used. These differences are due to the varying degrees of absorbability of the element used in their manufacture.

It has been determined that the wave lengths from 1860 to 2000 Angström units will be absorbed by the epidermis. From 2200 to 2400 Angström units they pass through the epidermis only. From 2400 to 2900 Angström units they are absorbed in the corium, while from 2900 to 3400 they pass through the corium. From 3300 to 3900 Angström units they pass into the subcutaneous tissues and from 3900 to 7700 they pass through several inches of soft tissue.

CHAPTER II

Radio-wave Frequencies.

In 1922, there was brought out a cutting instrument which has been variously called radio-knife, electro-scalpel, endotherm-knife, etc. Since 1922, several other similar instruments have been marketed all, however, using the same principle of radio-frequency. The original instrument used two 250-watt radio bulbs while the later makes have used as low as 50-watt radio bulbs. All of them cut the various soft tissues without resistance but leave the lymph and blood vessels wide open thus leaving in their wake more bleeding than a sharp knife as well as a possibility of secondary hemorrhage.

I used the original instrument in June, 1922, during the removal of carcinoma of the female breast. Healing followed but during the first ten days after the operation the drainage was excessive, apparently from devitalization of fat as the patient's temperature did not rise above 101°F. The later makes seem to cause less devitalization of tissue, but still have the defect of lack of hemorrhage and lymph control. These instruments are still in the experimental stage.

The following case illustrates the results obtained by its use in several cases: Case No. 13. Female, age 31. Was referred to me for treatment June 19, 1922. Examination revealed a large mass in the upper outer quadrant of the left breast which was adherent to the skin. The axillary glands were enlarged.

The breast and lymph-bearing tissues were removed en masse with the electro-scalpel using the radio wave lengths. The operation was uneventful but after the third day, post-operative, there was a large amount of drainage. The temperature was not above 101°F., pulse 110 and only staphylococci were found in the smears and cultures but the excessive drainage continued for about two weeks. The wound then closed without further incident. December 15, 1925, this case reported that she was in good health.

DIAGNOSIS: Carcinoma of the left breast with metastasis.

CHAPTER III

Apparatus.

In the following chapters no attempt will be made to definitely describe apparatus of any kind. It will be left to the manufacturers to describe their own wares which are many and varied for various purposes. No attempt will be made to describe every kind of a physiotherapeutic treatment. Only such apparatus as we have found from clinical experience in our own practice to be most valuable will be given. Diseases not listed in this work may be treated by modalities not mentioned for it is not given for one person to know all branches. However certain fundamentals must be considered and given bounds must not be passed if definite results are to be expected.

Actinic Rays. An actinic-ray apparatus must be capable of developing frequencies between 5000 and 1800 Angström units (round numbers) although its most useful clinical frequencies will be between 4000 and 2000 Angström units which are in the ultra-violet regions. These rays must be surrounded by some media which is transparent to rays of this length. At the present time only two substances are available for practical use: air, and either fused or crystal quartz. Air becomes opaque to the rays in the neighborhood of 2000 Angström units and beyond to 200 Angström units which takes us to the K, L, and M series of roentgen rays.

The frequencies from 200 Angström units to 0.07 (and beyond), which are the roentgen and radium rays, are also actinic or chemical but will be considered under their special headings, for they differ very much in their action from the longer actinic rays in the ultra-violet region and air is transparent to them.

In the following pages, actinic rays are used in preference to ultra-violet rays, which are actinic, for the reason that the lamps in use today (either carbon or quartz-mercury arcs) produce rays from the violet, indigo, blue, and green regions of the spectrum which contain an increasing amount of actinic rays in the reverse order given, i. e. from green to violet. There are enough chemical rays from these visible regions to be of clinical value.

Going back to the quartz mercury-vapor lamp it must be capable of developing continuously, or for several consecutive hours at least, chemical rays of wave lengths from 6000 to 2000 Angström units and if it will do this without personal attention so much the better. Two types of lamps are in practical use today, carbon and quartz mercury-vapor lamps. Each has its field of usefulness.

The Finsen Institute at Copenhagen still clings to the carbon arc using about 50 volts and 70 amperes per lamp. In the United States most users prefer the quartz mercury-vapor lamps, as they require less attention and less current consumption, which is about 9 amperes when the lamp is first started and 3 or 4 amperes after it has attained its equilibrium. These burners should receive care and be cleaned after 1000 or 2000 hours of use. I have one which is still active after 8000 hours of use.

There are two types of quartz mercury-vapor lamps, the air-cooled and the water-cooled, which are so designated in the following pages.

The air-cooled lamp must be used at sufficient distance from the skin to prevent heat burns, as these burners develop a very high temperature. The minimum distance these lamps can be used is at a distance of about 20 centimeters (skin target). Their maximum distance may be many feet if a sufficient length of time is allowed, however, the usual treatment distance is 60 centimeters, when starting a new case, to 35 centimeters for the cases under treatment for ten or more days. The above distances must be varied according to the reaction of the individual case, the frequency of the treatment, age of the patient, and type of individual. Blonds will, as a rule, become hyperemic much more quickly than brunettes.

Frequency. As a rule, we give daily treatments until there is definite progress, then increase the interval between treatments. This statement will be repeated frequently throughout the following pages, as it is extremely important that treatments should be given to every case at intervals close enough to maintain a continued progress if the best results are to be expected. One would seldom think of giving doses of drugs days apart; then do not give physical-therapy treatments several days apart. There are exceptions to this rule, as there are in giving medicine. For instance, in treating naevi, the treatments may be weeks apart without loss of effort, although such a method prolongs the time of the ultimate recovery.

Actinic-ray treatments must be given with the skin bare, for even a pocket handkerchief is nearly opaque to the rays and the treatment must be given at right angles to the surface treated or nearly so, or the rays will be deflected instead of absorbed. It is to be hoped that the time is not far distant when every manufacturer will put out a spectrogram of the apparatus sold. In this way the user will know its limitations.

High-Frequency Apparatus.

A high-frequency current is both relative and actual. For electrical power lines a few hundred oscillations per second is high, while for use in the practice of medicine the oscillations

should be nearly a million as a minimum, with a maximum probably not above three million, and from present indications not far above one and one-half million per second.

There is no one piece of physical-therapy apparatus which absolutely excels all other makes, for the manufacturers are constantly improving their output to meet the demands of the clinicians. What is best today or for any class of cases may be very poor in comparison of results in a few years. With physical-therapy apparatus it is much as it is with the automobiles—you get about what you pay for. You can get utility for a comparatively small price, or you can get the most in general service for a medium price, or for a high price you can get the most in specific service and good looks. However, several things you must have if you are to get clinical results that are up to the average from high-frequency currents.

There are three types of these currents in general use today: the d'Arsonval, the Tesla, and the Oudin.

The manufacturer is still in doubt as to the best frequency, the best voltage, and the best amperage, and if he ever determines this, it will be with the aid of the clinician. He can produce anything we as practitioners of medicine want, if he can find out what we want.

We do not know *just* what we want, although we are making rapid strides in the past few years. Today we want between 1 and 2 million oscillations per second. It would probably be best for most of our cases if we used between 1 and 1½ million. The more rapid the oscillations the greater the surface heat or surface dispersion, unless the voltage is high. Today we want a potential or no-load voltage around seventy-five thousand for the Oudin current, around thirty-five thousand for the Tesla, and around twenty thousand for the d'Arsonval current. These voltages drop instantly to about one-third the above figures when a patient is placed in the circuit.

In amperage we now want from our high-frequency machine a range from 0 to 3 amperes, or as the meters read 0 to 3000 milliamperes. A few machines will give you up to 5000 milliamperes, but before you use that quantity of current it is best to have a wide experience and then use a great amount of caution. Personally we never use over 2500 milliamperes and our average high milliamperage is around 1000. However, if we wish to use 2500 milliamperes we do not want a machine with that figure as its ultimate capacity, for any piece of machinery used for any length of time at full capacity is going to break down somewhere.

Remember the above figures are for the output of the machines, i. e., the current delivered to the patient. The street current consumption, that is intake, is from five to fifteen amperes of a low oscillation or frequency, usually sixty cycles.

Voltage control is another point for you to help settle. The increase and decrease of voltage during the treatment should be imperceptible to the patient. The properly balanced current is a most, if not the most, important part in the giving of a proper treatment. If you have too much voltage and too little amperage your current will be rough, spitty, and painful. On the other hand, if you have too much amperage and very little voltage you are giving only a surface treatment, for remember the voltage is the force or push in the current, while the amperage is the quantity. Now then when you mix in with the voltage and the amperage the spark gap with its numberless possibilities of change, which are necessary, you begin to see that what seemed simple when we had only voltage and amperage, now becomes quite complicated.

In order to properly balance our current we have spark gaps, voltage control, a milliamperage of from 0 to 3000, oscillations from one to three million. Figure out for yourself how many variations you can get from the various settings obtainable.

Personally, I hope the day is not far distant when some manufacturer will give us one control which will balance the current properly for all milliamperages. As the machines are built at present, it is necessary for the user, be that person an aide or a practitioner of medicine, to balance the current for each treatment. This is *most important*, but very difficult to describe. Every violinist must tune his own instrument at the time of using; so must the user of a high-frequency machine. As an average, I should say to use about twelve per cent of the voltage control for each hundred additional milliamperes required. This leaves the spark gap for consideration. Today the tungsten or nickle alloy contact-point gaps give the most satisfactory results, but these should be cleaned frequently, for even they corrode. Now, going to the final balancing of the current, with your voltage control set as above indicated, open the spark gap just sufficient to obtain the milliamperage desired. In general we would say use as narrow a gap as possible, which makes for smoothness. The maximum gap should not be over $1/32$ of an inch and a micrometer adjustment is necessary.

Several other things must be considered if the best results are to be obtained with a minimum of friction and irritation and maximum of comfort for both patient and user. A good meter is necessary for matters of record and a daily record should be kept of each treatment given. In this way, subsequent treatment may be gauged according to the results obtained without guessing at what the last treatment was, either as to modality, time, or quantity. However, do not give treatments with the meter as a guide. Its readings when used for matters of record make for scientific application, nothing more. Each treatment should be so regulated and so given as to be comfortable to the patient and to obtain the best results

and this cannot be accomplished by any set meter reading. Individual tolerance should always be our guide.

Where it is necessary to turn the current on and off frequently or rapidly, a good foot switch is essential. This gives the operator absolute control at all times, without conversation, which in itself may be valuable.

Cabinet designs and mobility are matters which affect the individual operator or the circumstances of a particular case and have nothing to do with the actual treatment. However, do not expect to get Lincoln power out of a Ford car. Various machines have various refinements, many of which are useful but not always needful.

Cords should be ample in size for current control and long enough to reach the part being treated without excessive rearrangement; however, they should be kept as short as practicable to avoid radiation or current loss.

Applicators are many and varied, most of them useful. For surface applications, particularly about the joints, we prefer composition metal of 36 to 40 gauge (B&S) for its pliability and flexibility. Twenty-five gauge (B&S) is a good thickness for the larger joints and smaller limbs. It can be shaped to fit the part at the time of use and in a few seconds. The cord tip can be placed in a suitable holder which is soldered to a strap of fine mesh wire about an inch wide and three inches long. This can be laid upon the composition-metal electrode which is held in place, *and this must be absolute with no possibility of slipping*, by holders of various kinds such as roller bandages, elastic bandages, or what we many times prefer, sand bags of various sizes and shapes and about one-half full of very fine sand. Large applicators for chest or back may be made of heavy composition metal of 22 gauge (B&S). This weight gives a smoother current and better dispersion for heavy amperages and should be used where convenient, but it is too heavy to mold about the smaller joints.

The ideal method of fastening the conducting cord to the composition metal has not been invented. All present methods have faults and it will be necessary for the individual user to have several methods at his command and use the one most applicable to the case at hand. Usually we prefer to roll our cord tip into the number 36 composition metal. This method works in most cases but is difficult to handle where osseous structures are close to the surface.

For cavity work, the factory applicators must be used in order to fit the part of the body under treatment. Vacuum applicators have largely given way to non-vacuum applicators which develop a slightly higher temperature and which are not so easily broken. These are used from the Tesla or, better still, from the Oudin post of the high-frequency machine.

Static Electricity.

Static electricity is not described in this volume because the writer is not familiar with its use and prefers to refer the reader and those desiring accurate knowledge of this current and its use to the writings of the following persons who have used static electricity consistently and continuously for many years. William J. Morton who developed the "Morton Wave," Frederick DeKraft, William Benham Snow, J. Willard Travell, Chris. M. Sampson in America, and W. J. Turrell in England.

CHAPTER IV

Diathermy.

Diathermy is a term first used by Nagelschmidt in 1907 and it is still the most descriptive term we have to describe the action of a high-frequency current of the bipolar or d'Arsonval type. D'Arsonval had in 1890 demonstrated the heat effect of the high-frequency current which bears his name. It means heat produced within and is the converse type as described by Major Chris. M. Sampson.

The heat produced from this type of current is electrical energy converted into heat energy by friction. The resistance of the body tissues to the passage of the current produces the friction and there is developed the very long infra-red rays (between one and three trillion Angström units).

If you will always think of diathermy as infra-red heat waves, heat, nothing more, the mystery will be taken out of the d'Arsonval current. So far as known there is no electrical action; one alternation neutralizes the one preceding it so there is no polarity effect. If the applicators are of the same size, the greatest heat will be midway between. If, on the other hand, one applicator is 8 by 10 inches and the other a needle point, most of the heat effect will be concentrated at the needle point. Remember this is not because there is more heat at one pole than the other; both have an equal amount of current, but there being the same amount of current at both poles, the one having the needle point applicator will have all of its heat concentrated at that point, while the indifferent pole having an 8 by 10 electrode will have its equal amount of heat distributed over eighty square inches of surface.

Using these two illustrations as a basis, it is readily seen that one can vary the depth to which the greatest amount of heat may be placed, and diathermy is the only method we have by which such varying depths can be controlled at the will of the operator, and this without damage to the intervening tissues. What we cannot control is the degree of heat delivered at a definite point. This will be readily understood when one considers the varying blood supply within the various tissues and how readily these varying supplies are changed by pathological processes. The blood stream is an effective cooling system and dissipates heat rapidly so that what seemed at first as a very simple heating process soon becomes a complicated one. This rapid heat dispersion is not as serious a handicap as it may seem at first, for heat in sufficient quantity can be developed in the various tissues

to make it effective for the relief of many disorders, particularly inflammatory disorders due to trauma or infection, and these are many and varied.

Heat enough to kill or disable gonococci is easily developed in many tissues, as 106° to 108° F. is sufficient and is much below what the normal tissues will stand without damage, which is considerably over 120° F.

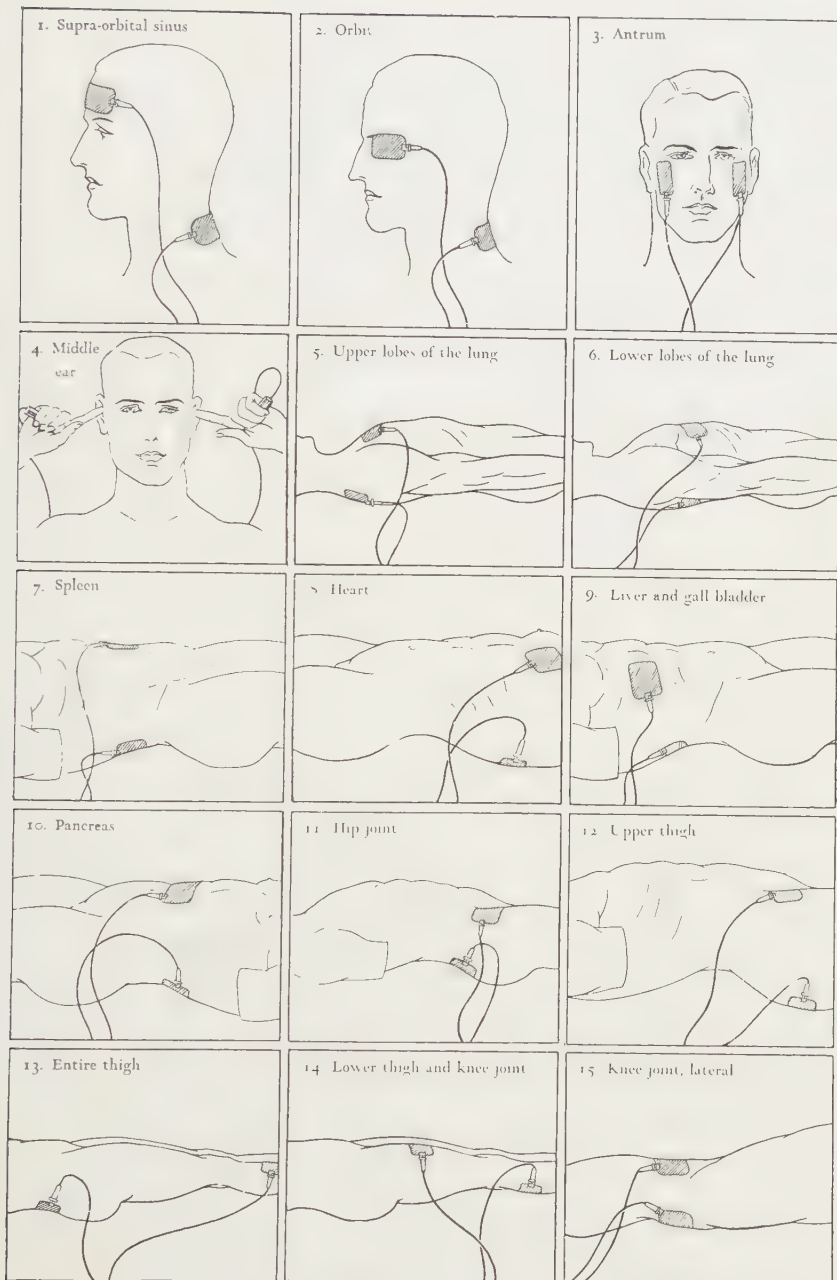
On the other hand, we are not able to develop sufficient heat in all involved tissues to destroy malignant cells, which takes around 120° F. for thirty or more minutes. A technique may be developed that will do it, but a moment's thought will show how difficult this will be to accomplish. Take, for example, the female breast, with its varying amounts of fat, which is almost a non-conductor of electricity. Given a mammary gland overlaid with several inches of fat and it would be impossible to penetrate it to reach the gland proper. Even if this were possible, the nipple will stand comparatively little heat, not sufficient for malignant cell destruction.

High-frequency currents travel in straight lines unless they meet with resistance when, true to all electrical currents, they take the lines of least resistance and also travel the shortest conducting routes so that when we reach the axilla, with its extra blood supply and its lymph drainage from the breast, electrodes are difficult to coapt with the skin, which is more sensitive because of constant maceration. If the indifferent electrode is placed on the back, the current will *short* along the skin; if placed in the opposite axilla the heat will not be properly placed in the pathological tissue, neither will it be of the proper temperature, all of which goes to prove that diathermy has its limitations. However, for limbs and joints it is easily applied and controlled in most cases. The same may be said of the thorax. Here diathermy is of the definite value in treating pneumonia. For details see Dr. H. E. Stewart's book on "Diathermy and its Application to Pneumonia," 1923.

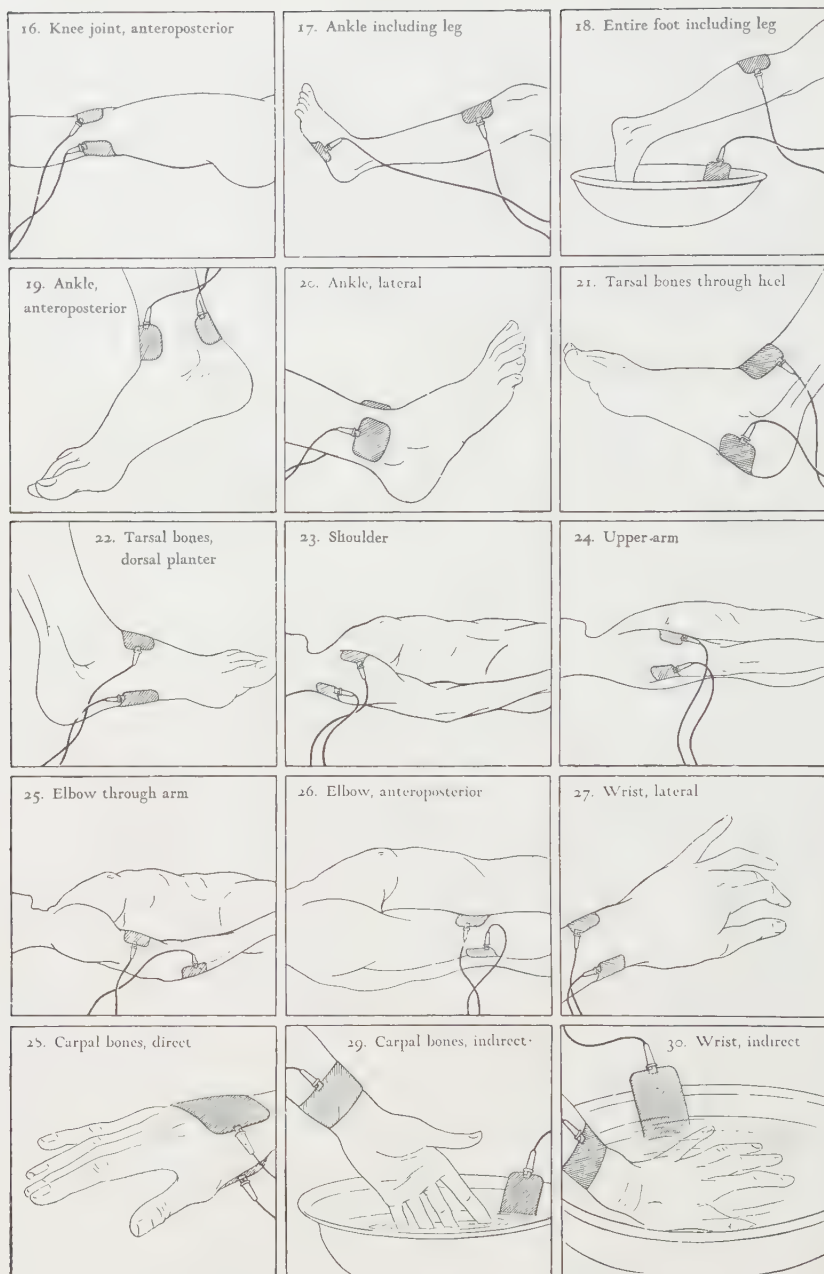
For the proper application of the electrodes see plate III.

As to the proper amount of current to be used, it will always be the individual patient's tolerance whether this is sufficient to produce the degree of heat necessary for effective use or not.

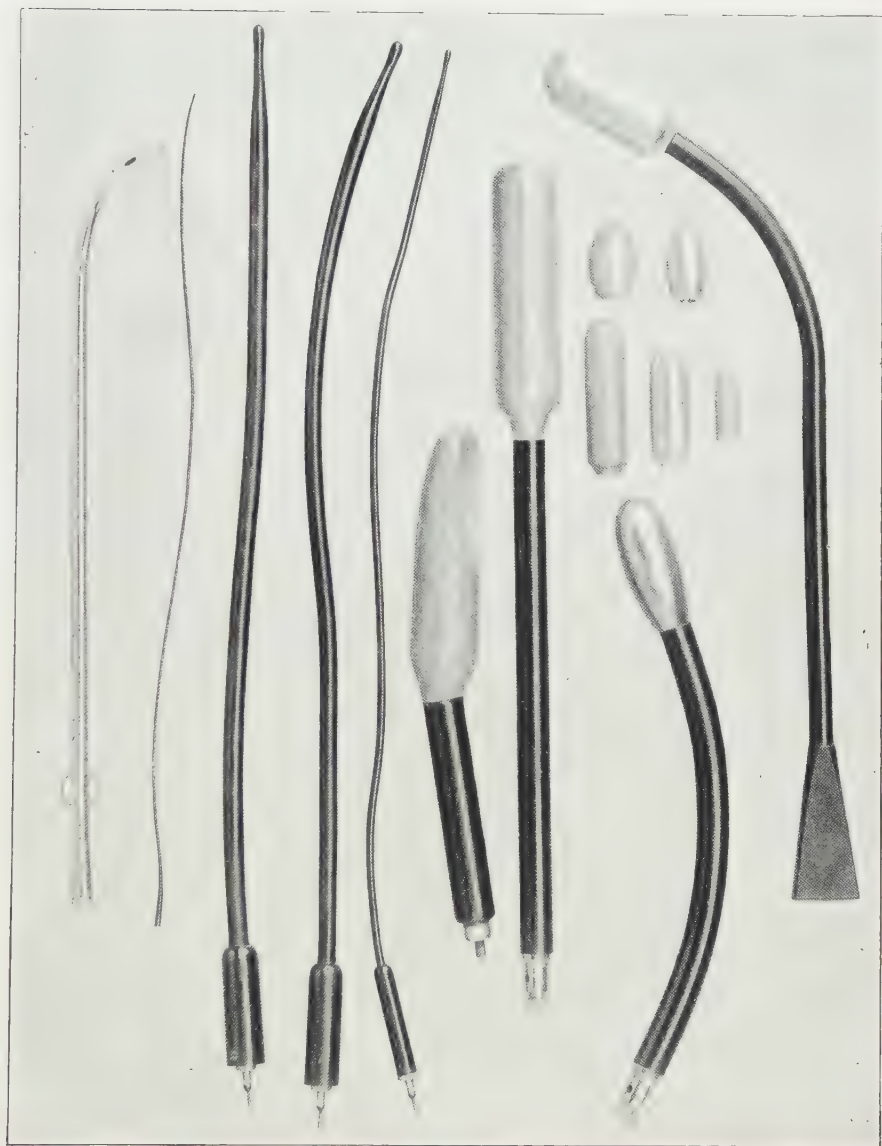
It would be manifestly unwise to use current enough to cause pain even if it did not cause a burn, which it would do if continued long enough. This is a simple deduction, for it is intense heat at one point that causes the pain or discomfort. Usually it will be found that one of the electrodes and the skin are not properly coapted. If the patient complains of anything beyond a comfortable degree of heat, remove the electrode and reapply it more carefully. If you are certain of its proper application, then re-



The pictures on this page are merely suggestions for the placing of electrodes. Each case must be individualized.



The pictures on this page are merely suggestions for the placing of electrodes. Each case must be individualized.



Dilating catheter, heat bougies for treating strictures, diathermy electrodes for vaginal and rectal treatments.

TREATMENT

[illegible]

duce the milliamperage to the point of comfort for that particular case. A good safe average amount of current will be around fifty milliamperes per square inch of the smallest electrode. This may in some cases be increased to one hundred milliamperes or even more in selected cases and selected areas. For instance the middle of the thigh will tolerate much more current than the ankle joint, or in other words soft tissues with their increased blood supply will tolerate more heat than bone with its limited blood supply. It is of course understood that I have been talking of medical diathermy.

Surgical diathermy is a destructive process and should always be so considered. When used surgically, we use an 8 by 10 inch composition-metal electrode (see plate VII) for the indifferent pole. This electrode is strapped on to some portion of the body, usually the back, where it is out of the way. It must be strapped on with no possibility of its coming loose and producing a burn, for in this instance we are going to use very heavy currents usually starting at a minimum of 300 and going up to as high as 2500 milliamperes through a needle point. We almost invariably use an aluminum needle for our active electrode in doing surgery with diathermy. Exceptionally we use a disk where we do not wish to produce so much destruction and where we wish to drive the heat further into the tissues. The size of the disk will depend upon the depth we wish to drive the heat, but usually it is from one-half to two inches in diameter. In applying the indifferent electrode, it is not necessary to moisten or lather it and *never* use a wet-pad electrode for doing surgical work. It can be used, but is too dangerous to recommend for general use, as the moisture is evaporated rapidly and if the pad is not watched, dry spots will appear and a burn is almost certain. The only exception we ever make to applying a dry composition-metal electrode is about joints, particularly the hands of the aged, where the sweat glands are not normally active, then we moisten the electrode with warm water only. The reason one can apply a dry electrode to 95% of the cases is that the warmth produced by the current causes an immediate sweating beneath it. You will remember that perspiration contains sodium chloride; therefore, the best conduction possible is provided, water and sodium chloride.

The reason we use composition-metal for our applicators is that it makes an air-tight contact which prevents the evaporation of the perspiration; therefore, the longer it is used the better the contact.

One point is well worth remembering, in fact should never be forgotten, and that is, start the current slowly even for large pads. Gradually increase the current up to 200 or 300 milliamperes and let it remain at this point for about five minutes. This

will gradually warm up the tissues, start the perspiration, and lower the local resistance, after which the current may be increased to tolerance. For surgical diathermy see Chapter on Electrocoagulation.

Extreme caution must be used in cases of sensory paralysis from any cause. In fact it is best not to use diathermy in these cases if it can be avoided, for the danger of burns is very great. Diathermy produces an increase in blood sugar (Pincussen *Strahlentherapie* No. 3, 1924).

SURGICAL DIATHERMY

Electrocoagulation and Electrodesiccation.*

Much has been said, written, and performed regarding surface malignancies. The various methods have produced varying results depending largely on the skill of the user. Some of the older methods are still in use with a fair degree of final success, but the intermediate stages are slow and exceedingly painful.

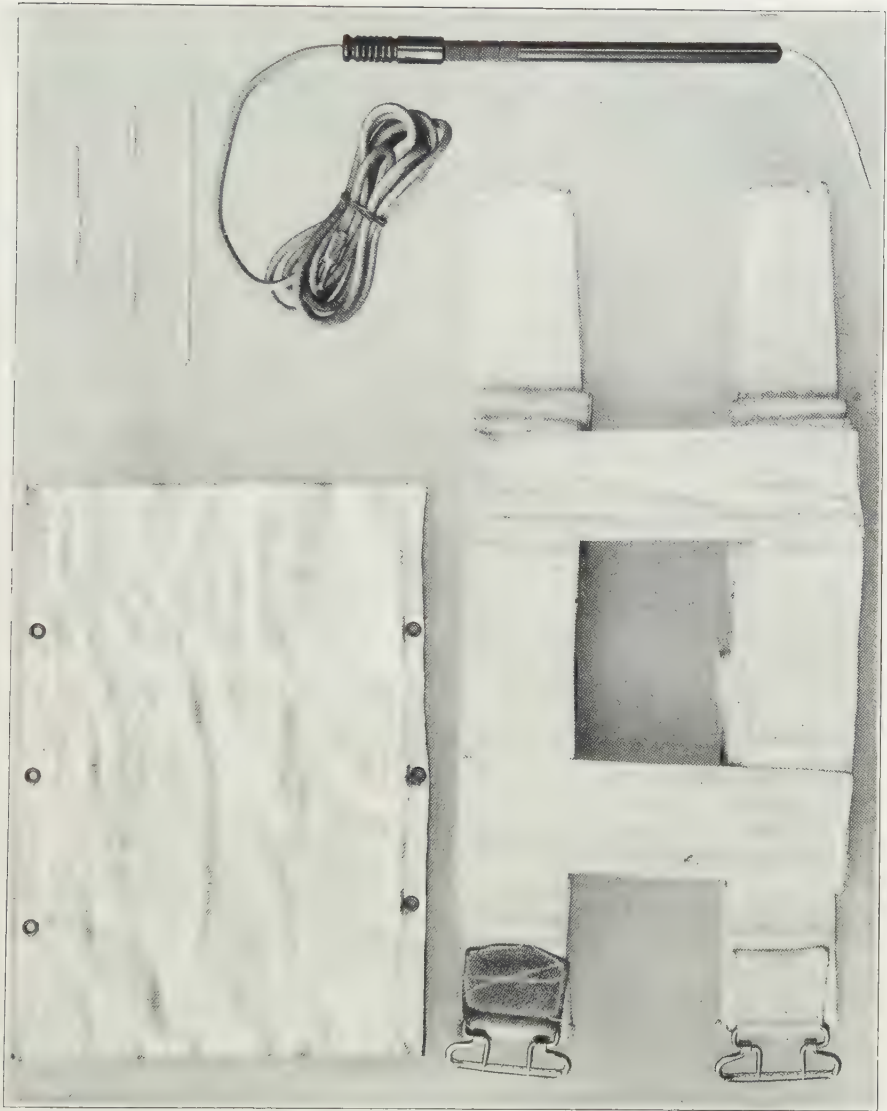
Heat in various forms has been used far back into the history of medicine, but notwithstanding this, we are still in doubt as to the exact amount of heat necessary to destroy cancer cells in situ and the best method of developing that amount of heat within the living human body. It has been quite definitely settled that a temperature of 116° F. is sufficient to devitalize cancer cells. This amount is, theoretically, easily generated and it is not sufficient to destroy normal cells which will stand a temperature of 125° F. for several minutes. Practically, it is difficult to reach 116° in living tissues with an approximately normal blood flow, for the blood stream dissipates heat rapidly.

Until the development of high-frequency apparatus, we were limited to heated metals which could not be maintained at a uniform temperature, so they were either too hot and thus destroyed normal as well as malignant tissues, or else they were of too low a temperature to destroy the malignant cells. In any event, their action was superficial.

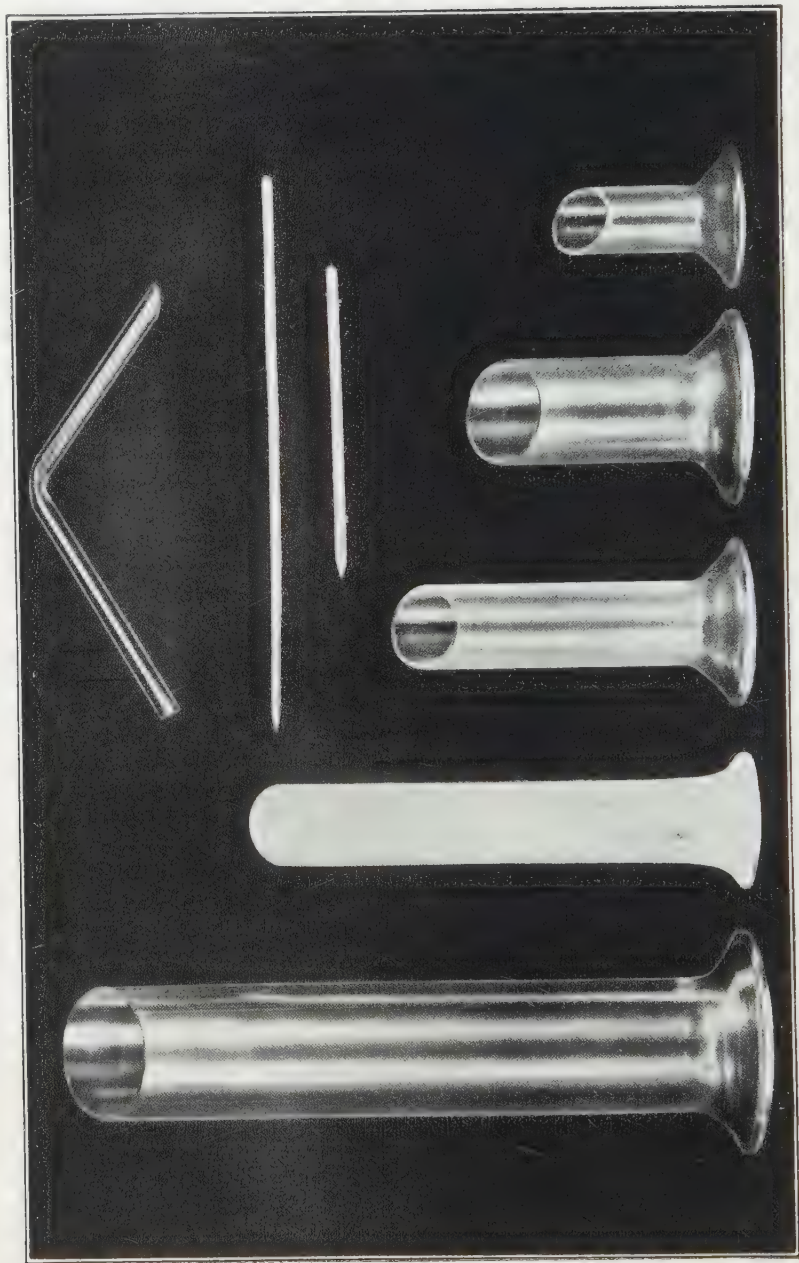
With the recent output of high-frequency apparatus, we have a very definite method of controlling heat from the point of heat generation, but are still uncertain of the amount of heat generated and retained in living tissues through which blood is circulating and which rapidly dissipates the heat thus generated, so for treating deep malignancies present methods leave much to be desired.

In sharp contrast to this we have advanced rapidly in the treatment of surface malignancies during the past decade, where

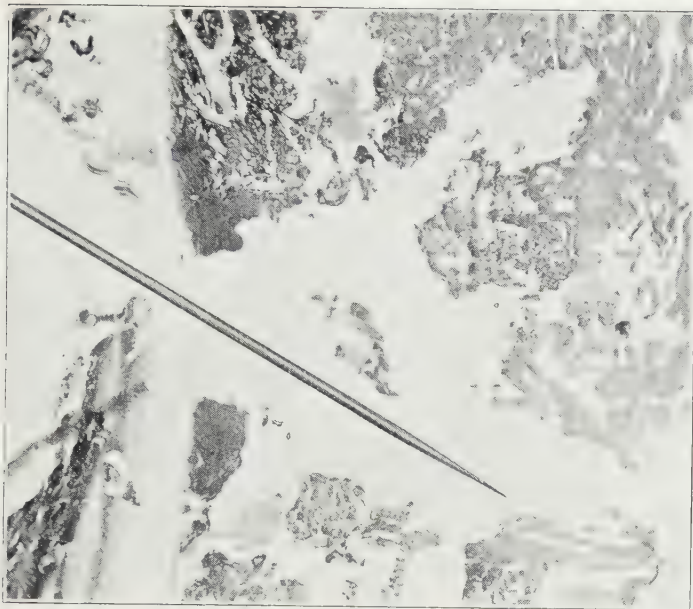
*Read before the American Electrotherapeutic Association, September, 1925.



Electrocoagulation handle, cord and needles. Indifferent electrode and canvas straps for holding same in place.

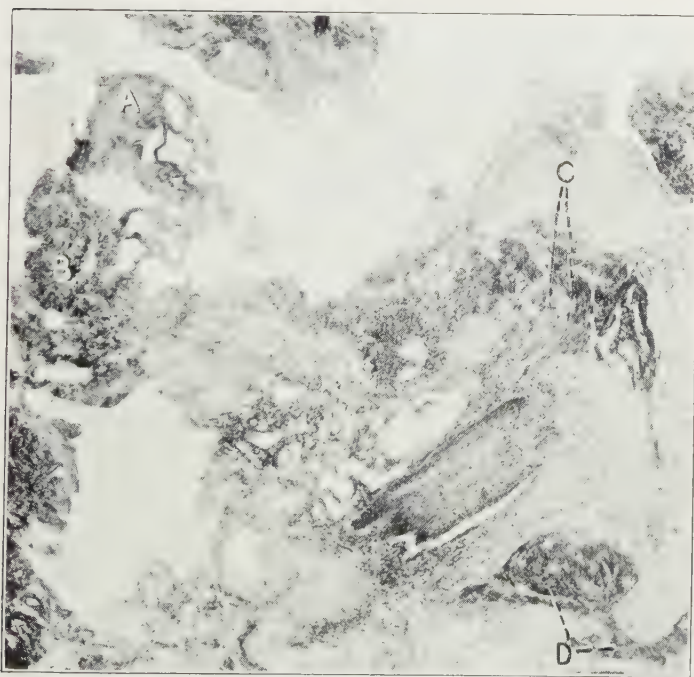


Tubular applicators used when coagulation in cavities, also needles and glass suction tube.



MAG. 21 DIA.

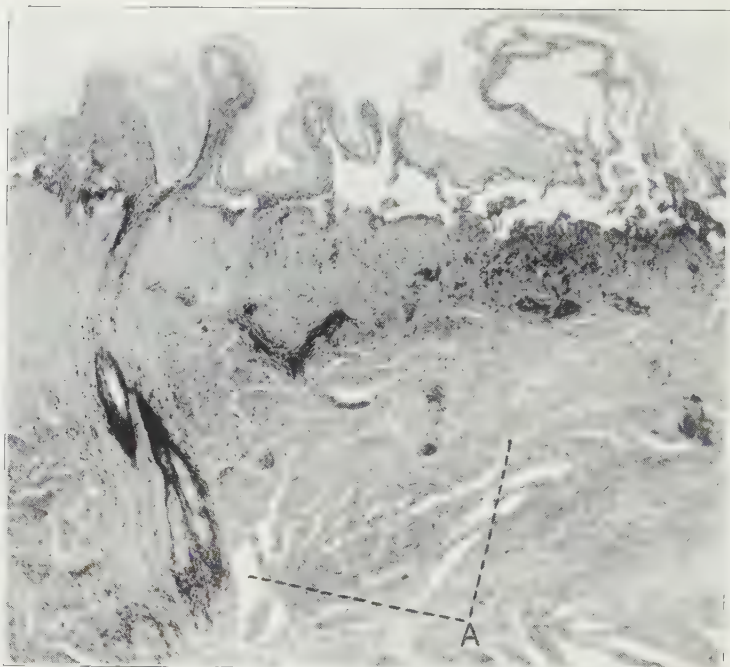
Area of cauterization with charring of the edges and necrosis of the balance of the tissue.



MAG. 51 DIA.

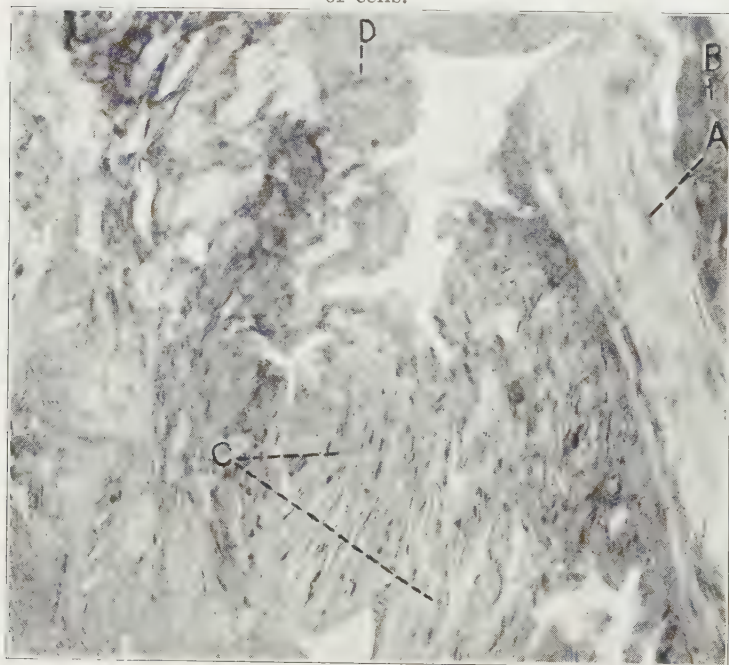
(a) Necrosis. (b) Contraction of fibrous tissue. (c) Contraction and desiccation of tumor cells. (d) Contraction of tumor cells showing distance of normal from coagulated tissue.

Plate IX



MAG. 70 DIA.

Coagulation showing separation of epithelial layer from corium with necrosis of epithelial layer. Lower right side of picture shows contraction and desiccation with separation of cells.



MAG. 230 DIA.

(a) Shows necrosis. (b) Charring. (c) Contraction with formation of elongated spindle cells. (d) Blood cells.

we can visualize the action of the heat as we are using it. Here we have two definite methods which have passed the experimental stage and the value of which, when properly used, has become a settled factor in the treatment of these lesions. These methods were developed in the United States by Dr. William L. Clark of Philadelphia and it is to his untiring efforts that we have them today in their perfected form. These two methods, both of which are produced by the same piece of apparatus, are electrodesiccation for small superficial lesions, and electrocoagulation for the larger, deeper surface lesions where the circulation is more free.

The Oudin current is used for electrodesiccation. This current has no meter measurement, as it is unipolar, but for most cases the machine should be so balanced as to give a white flame of about one-fourth inch skin-applicator distance. If the voltage is too high, there will be a wider jump, which is not easily directed to the exact spot desired and which is insufficient in desiccating qualities. By this method the tissues should be slowly dehydrated but not carbonized. This dehydration causes a separation of the diseased from the underlying normal tissues so that it can be removed by sponging if superficial, or by curetting if the growth extends into the deeper tissues. For superficial growths there is very little scarring and even for the deeper lesions the scar is surprisingly soft and not extensive. After removing the diseased tissue, the entire area should be lightly seared over to prevent serous oozing and subsequent infection. The after dressing is dry, sterile cotton or gauze and when the eschar separates, it is well to keep the area sterile with actinic rays from the water-cooled mercury-quartz lamp. If there is no bone involvement, these wounds should heal in from two to eight weeks.

The d'Arsonval or bi-polar current is used for electrocoagulation. The indifferent electrode is placed at some distance from the lesion to be treated so it will not interfere with the operative procedure. By preference, we place it on the patient's back, using a piece of heavy composition-metal (22 B&S gauge) about eight by ten inches in size, strapped on to avoid any possibility of displacement and a consequent burn. This piece of composition-metal is placed in direct contact with the skin without either moistening or lathering. For the active electrode small discs may be used, although we prefer an aluminum needle of suitable length for the lesion being treated. This electrode is to be insulated with rubber tubing to within an inch of its tip. This insulation is sufficient for all amperages, but not all voltages.

When coagulating soft tissues, the needle is inserted into the tissue encircling the border to shut off the possibility of metastasis and to stop all bleeding. The center of the mass is then coagulated and removed by scissors or curette, depending upon

the character of the tissue involved. The coagulation is then repeated until all diseased tissue is destroyed. While it is possible to use several sittings to destroy a growth, it is unwise to do so if it can possibly be avoided. A very serious effort should be made to complete the destruction at one operation.

If bone is encountered and has to be removed, the periosteum is first destroyed with the other soft tissues, then the point of the needle is placed against the bone and enough current used to cause it to become incandescent for an instant, at which time it becomes white hot, destroying the life of the bone cells so heated. The needle is then moved to a new area until all diseased portions of the bone are destroyed. Usually the dead bone is left in situ until separated by absorption, which usually takes place along the margin of the healthy bone and the healing is completed in about four more weeks or four months in all. Where soft tissue alone is destroyed, healing should be completed in from four to eight weeks, depending upon the size of the lesion. The amount of current used will depend upon the size and the location of the lesion, but should always be sufficient for steady coagulation, usually from 500 to 1500 milliamperes.

A good foot switch is essential for proper control of the current by the operator.

It is even more essential to have a proper anesthetic so there will be no interruption once the operation is begun and this anesthesia must be of such a character that there will be no danger of its exploding. I have, therefore, developed a form of "Twilight Sleep" which approaches the ideal. I use for the average adult in average health, morphine sulphate $\frac{1}{4}$ of a grain and hyoscin hydrobromate $\frac{1}{100}$ of a grain, two hours before the time set for the operation, repeating this dose one hour later. This usually gives complete narcosis, but if the patient shows signs of moving, enough ether is poured to obtain complete relaxation, then it is discontinued and removed from the operating room. Any kind of an operation can be performed under this anesthesia. In the extremes of age, it must be used in smaller doses and with extreme caution. Under this anesthesia the patient will sleep from six to twelve hours. The heart beat is rapid at first, but soon returns to normal, while the respirations become very slow, usually from six to twelve per minute. We have had the respirations go as low as four per minute, but to date have not used anything to stimulate them. The ether must not be used beyond the point of complete relaxation. Besides keeping the patient quiet during the operation, this method has the advantage of putting the patient asleep in bed with only the nurse present and of keeping him asleep for some hours after he has been returned to bed.

During the operation and after returning to bed, the patient's skin is warm, showing absence of shock. As this method of anes-

thesia keeps the patient asleep for several hours the usual immediate post-operative pains are avoided, therefore it largely takes the place of the anoci-association of Crile and has the advantage of longer relief, for the patient does not regain full sensory acumen for at least twenty-four hours.

When the action of the current on the tissues is considered, the freedom from subsequent pain is easily explained. The production of pain is mainly from three causes: inflammation within the nerve sheath producing pressure from within, impingement of nerve filaments by pressure from without, and exposure of nerve filaments to the atmosphere. When using electrodesiccation or coagulation all infections are destroyed within the heated area and the tissues are sealed against subsequent infection, thus limiting the zone of post-operative inflammation. Nerve filaments in the diseased area are destroyed and sealed from atmospheric contact.

These methods of destroying surface malignancies are superior to all other methods, and when I speak of surface malignancies, I mean the surface of accessible cavities as well as the external surface of the body, for the following reasons:

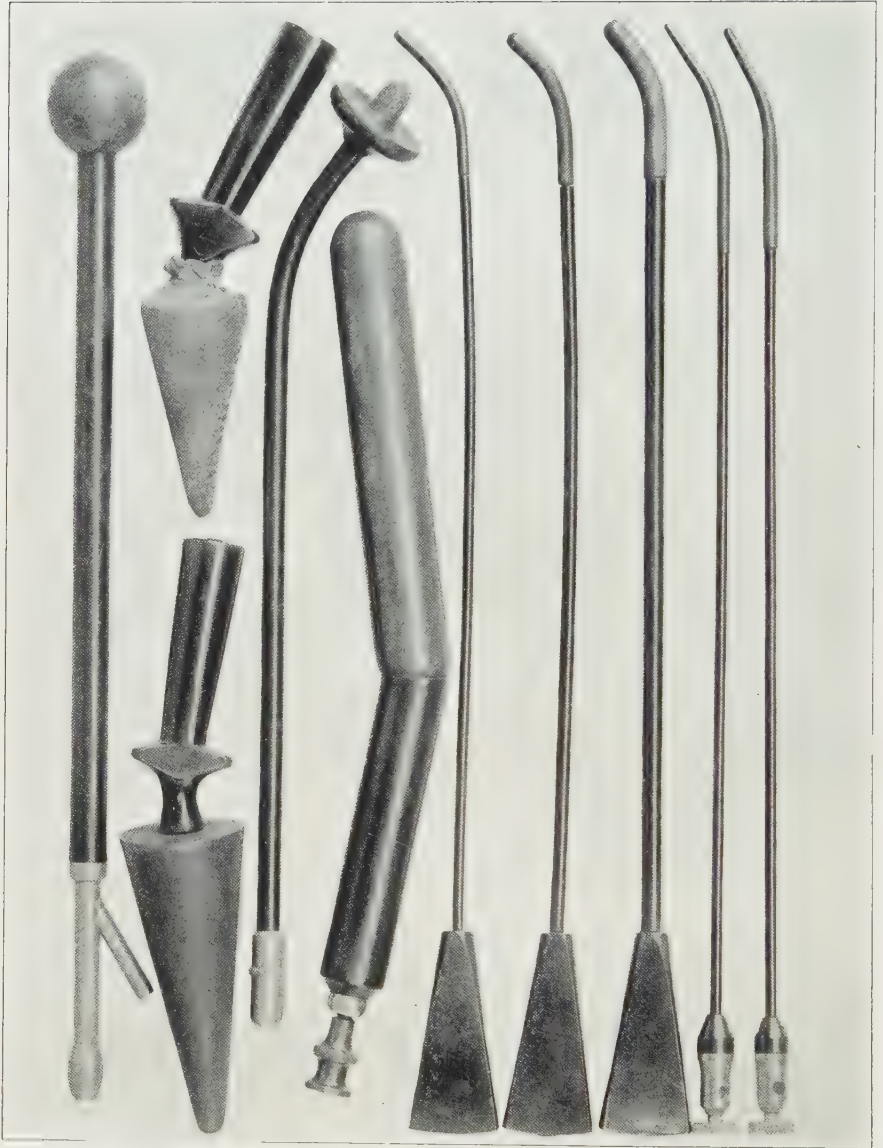
1. Because there is complete destruction at the time of operation leaving only a simple sore to heal.
2. One has perfect control of the destructive agent.
3. There is no loss of blood.
4. There is neither immediate nor remote pain.
5. Because there is no immediate or remote pain and no loss of blood, there is no surgical shock and the absence of ether reduces the post-operative discomfort.
6. The wound is rendered sterile and the sloughing, odorous mass removed during one sitting.
7. Healing is rapid and the scar is soft and pliable.
8. The applicator is not heated, so there is no danger of accidental burns when the current is not flowing, for the heat is generated by the resistance of the tissue to the passage of the current. As the current passes through the body to reach the opposite pole, the tissues for several inches beyond the point of contact of the applicator are heated sufficiently to destroy malignant cells.
9. Last, but most important, all lymph and blood vessels are sealed against infection immediate or remote and implantation or metastasis prevented.

The only disadvantages of these methods are:

1. The inability to see the depth of the destruction, which must be continued until every vestige of the disease is removed. This disadvantage is largely overcome by the ease with which the diseased tissue is removed after destruction.
2. The inability to treat metastatic growths. These must be treated with surgery, radium, or roentgen rays or a combination of these methods. Neither electrodesiccation nor electrocoagulation should be used in any locality where there is inadequate provision for the subsequent removal of the destroyed tissue.

While this chapter is written on electrothermic methods, it must not be assumed that I have discarded all other methods. On the other hand, I use everything that has been found of value and the results I have obtained in the treatment of neoplastic diseases are due to the combining of various methods, but they would take me beyond the bounds of this paper to give them in detail.

Electrothermic methods excel all others when only one method is considered.



Copper applicators used in giving galvanic treatments. These are all used on the positive pole.

CHAPTER V

Galvanism.

While static electricity was discovered in 600 B. C. by Thales of Miletus, it remained for Galvani, in 1790, to discover what we now term galvanism after its discoverer.

Galvani by accident hung a frog by its legs on copper wires which were fastened to an iron beam and a little later noticed that the legs twitched. While he recorded the fact he did not ascertain the cause, which remained a secret for five years, when Volta, by experimentation, ascertained that it was due to the difference of potential between the two metals; thus we have the real birth of the knowledge of what we now term the galvanic or direct current. Here again we have proof that human minds working alone do not advance very far in an analysis of natural phenomena. Real advancement is made by using the knowledge of past centuries as stepping stones; thus it is that recorded experiences, although many times in themselves indefinite, lead to definite scientific knowledge.

The most simple galvanic cell is made by taking a piece of silver and a piece of copper and placing them on the tongue, allowing the free ends to come in contact at which time a current of galvanism will be felt and tasted. All galvanic currents from the mildest to the strongest are due to differences of potential.

All galvanic currents have polarity, one metal or terminal being positive and the other negative. The flow of a galvanic current is from the positive to the negative. The positive attracts negative ions which the negative has repelled; likewise the negative pole attracts the positive ions which the positive pole has repelled which follows the universal law of nature that *likes repel while unlikes attract*. The positive pole is acid, the negative is alkaline. If both poles or terminals are placed in water, the hydrogen is attracted to the negative terminal and oxygen to the positive terminal. All electric currents, whether direct or alternating, have three points of similarity, amperage or quantity, voltage or force, and ohmage or resistance.

Electric currents, either direct or alternating, are measured in amperes, although we pay for our commercial currents in wattage. Wattage is the voltage multiplied by the amperage.

Galvanic or direct currents are obtained in two ways: from cells, wet or dry, or from magnets, generators, etc. When the latter are used, they must be very rapid or the current will have a faradic sensation.

Alternating currents are direct currents flowing in both directions, i. e., the polarity changes with each alternation or oscillation and for this reason there is no polarity effect at the terminals, as one alternation is neutralized by the polarity of the one preceding. Bost produced alternating currents of fifty billion alternations per second.

Any resistance offered to the passage of an electric current is known as ohmage. The resistance of conducting materials vary directly as their length and inversely as their cross section, i. e., small wires offer more resistance than large ones; therefore, if one would avoid heating the intake wires from street currents for heavy physical-therapy equipment, be sure that the wiring is of ample diameter. It saves both current consumption and vexations from burned fuses or circuits. If 40 amperes of current are called for, a No. 14 wire will do, while if 100 amperes are needed, use not less than a No. 2 wire. I know of nothing more aggravating than to have a fuse or wire burn out while giving a treatment. See that they are ample, for it is money well spent.

Always remember that there is a definite relation between voltage, amperage, and resistance. A gain or loss to any one of these three factors is a gain or loss for one or both of the other factors.

As an ampere of current flowing through a patient might be very destructive, the meters furnished with all electrotherapy apparatus are rated in milliamperes or 1/1000 of an ampere. In using a galvanic current, we seldom use over 30, and for many treatments only 3 to 5 milliamperes.

I wish to emphasize the thought given in the Chapter on High-Frequency Currents, that the milliamperage should not be used as a guide in giving treatments, but one should use a sufficient quantity of current for the action desired, using the meter as a guide and for matters of record or to ascertain if the current is flowing.

The essentials of a galvanic equipment are: an adequate supply of direct current, a rheostat for the control of the current to the patient (and this must be of such character as will increase or decrease the current of *gradations* unobservable to the patient, of which the shunt-type is the best in use today), a milliampere meter graduated from a fraction of one milliampere up to the number it is desired to use. Dr. G. Betton Massey uses up to 2500 for his destructive work in cancer. Ordinarily a meter reading from 1 to 100 will be more than ample for galvanic treatments. The refinements of the various machines add to the ease of application and control.

Quoting from Neiswanger's *Electrotherapeutic Practice* (24th Edition), to which the reader is referred for details, we have the following:

Positive Pole	Negative Pole
1. Oxygen	1. Hydrogen
2. Acid	2. Alkaline
3. Will stop bleeding	3. Increase bleeding
4. Sedative	4. Produces hypersensitiveness
5. Hardens tissue	5. Liquifies and disintegrates
6. Is an acid caustic and hardens cicatricial tissue	6. Is an alkaline caustic and softens cicatricial tissue
7. Is a vaso-constrictor	7. Is a vaso-dilator

To avoid the polarity effect, the applicator on the indifferent pole should be large and well moistened with a sodium-chloride solution to reduce resistance. The asbestos, rubber-covered applicators are best and safest.

The applicator on the active pole will necessarily be of such shape and size as will best meet the requirement of the individual case. The active electrode must be of such metal as will be acted upon by the polarity used if an electrolytic action is desired. Thus, if one wishes the action of copper in the tissues, a copper electrode must be used on the active pole. That the copper is actually driven into the tissues is quickly determined after starting the current for the metal becomes disintegrated and the tissues green from the absorbed copper. Oxychloride of copper, which is formed by the union of the oxygen at this pole, and the copper from the electrode, is probably not carried into the tissues as such, because oxygen and chlorine are both electro-negative and have a strong affinity for the positive pole so that after being formed it is again broken up and the copper, probably colloidal in form, is carried toward the negative pole. In using copper in this way, "metallic cataphoresis," we not only get the sedative action of the positive pole, but a very decided bactericidal effect of the copper, which makes this phase of the treatment valuable in infective pathology.

Other metals can be used in the same way except that one must ascertain whether the metal is electro-negative or electro-positive. Mercury and zinc are both electro-negative, therefore are used on the positive pole. In the main, all metals have a positive ion charge, while the acid radical has a negative charge. Their affinity is therefore for the opposite pole. Remember like charges repel, while unlike charges attract. In this instance the copper is electronegative, i. e., it has an affinity for the negative pole and becomes disintegrated in an effort to reach it, and in this way is deposited in the tissues between the poles. From the above, it will be seen that the pathology being treated must be between the poles and as the active electrode is placed in, on, or near

the pathology, the indifferent or inactive electrode must be placed as nearly as possible on the opposite side of the diseased area.

One thing in medical practice that must be remembered and used to a greater extent than it is today is that acidity is destructive to human tissues and that lowered alkalinity is the beginning of destruction.

Lowered alkalinity may be brought about by fatigue either from excessive exertion, either mental or physical, or by mechanical or electrical stimulation and, of course, by the excessive administration of acids or acid-producing substances. As the body is largely composed of water and as water is disintegrated by electricity, which is easily determined by the method of polarity testing given above, it stands to reason that this same electrolytic action is going on during a treatment with the galvanic current so that with a small electrode and a heavy current, disintegration of tissue is rapid. Dr. G. Betton Massey makes use of this action in the destruction of carcinomas and sarcomas by electrolysis, wherein he uses zinc needles amalgamated with mercury for his active electrodes.

The production of acid in the tissues must be remembered whenever the positive pole is used for the active electrode. This electrode is sedative because it means the beginning of dissolution. Tissues can be destroyed by the negative pole which produces an alkalinity in the tissues surrounding the electrode. This can be very concentrated if, for instance, a needle is used for the electrode as in treating hemorrhoids. As inflammatory reactions are hyperalkaline, the positive pole sedates and the negative pole aggravates these reactions.

As electrons have proved to be negative, it may be that in all inflammatory processes the normal arrangement of negative electrons has been disturbed. Proof is fairly positive that the proton or positive electron is *stationary* and the negative electrons are in motion about it, probably rotating in an orbit.

Quoting from Neiswanger again, "Is it a violent supposition to say that, by violating the laws of nature we have polarized—reversed the direction of these nerve currents and thereby caused acid and alkaline conditions to appear where not intended?"

In treating inflamed pathology where the positive pole is used over or in the inflamed area, the excess of alkali is not neutralized but is transferred toward the negative pole where it is *diluted sufficiently to render it harmless*.

Cataphoresis is so little used by the average physiotherapist that it will not be discussed but should be used on special occasions. It is an electrolytic process followed by absorption of the disintegrated products or ions.

The positive pole dehydrates the tissues rapidly and at times is exactly what we wish. When treating a fistulous tract with a

copper electrode, it should just fit the fistula, use enough current (average 20 ma. for ten minutes, frequency once a week) to dehydrate the tract lining, thus causing the copper electrode to adhere to the wall. When this electrode is forcibly removed, it will bring the wall with it, leaving a granulating surface which will, many times, adhere and close the tract. The same method may be used for treating chronic endocervicitis.

When using the copper electrode for hemorrhoids, it is best to cover it with chamois skin to prevent it from adhering. This can be moistened with water to soften it, after which it should be well lubricated with tragacanth lubricant which is water soluble. Never lubricate with oil or grease, for they are non-conductors. The hemorrhoid can in this way be partially dehydrated each treatment. When treating hemorrhoids use the positive pole with an average time of ten to fifteen minutes and a milliamperage of 3 to 20 two or three times a week. The hemorrhoidal electrode should be cone shaped.

For vaginal treatments with the copper-ball electrode, the ball may be covered with absorbent cotton wet with a five per cent copper-sulphate solution. This prevents adherence and the copper-sulphate solution is immediately driven into the tissues while the disintegration of the copper ball is taking place. Average time of treatment ten to twenty minutes, milliamperage 10 to 40, frequency daily to weekly for acute and chronic inflammations and infections.

Urethral caruncles may be treated with a copper electrode as the positive pole, milliamperes 3 to 10, time ten minutes, frequency once or twice weekly, or they may be treated by blanching with the negative pole. A fine steel needle should be inserted into the base for a few seconds with a milliamperage of from 1 to 5. Hemorrhoids may be treated with the negative pole in the same way.

Erosions of the cervix, not eversions, may be treated with a copper electrode as the positive pole. The milliamperage should be 5 to 20 given up to fifteen minutes twice weekly. Continue treatments until the tissues are a decided green. Place the negative pole on the abdomen.

Pyosalpinx is relieved and many times the tissues completely restored to normal by the use of the copper-ball vaginal electrode as described above under vaginal treatments.

Urethral strictures may be treated with galvanism, but here use the negative pole on a nickle-covered bulb electrode. These are made in several sizes and the one should be selected which will not go through the stricture. This is placed against the stricture and is then attached to the negative pole, the positive pole being placed over the lower abdomen. The current is turned slowly to tolerance and slight pressure exerted. The treatment should be

continued until the stricture softens and the bulb passes through. The time should be from one to five minutes, with a milliamperage of 3 to 10, according to the size of the bulb electrode. The treatments should be given once a week.

Trachoma, lupus, and chronic non-malignant ulcers may be treated with the copper electrode on the positive terminal. Iron electrodes may be used for the styptic effect of the iron plus positive galvanism.

When the bare copper electrode tends to adhere, this can be prevented by rotating the electrode slightly during the treatment, and if by accident it adheres it can be loosened by reversing the current. When the negative pole is thus attached, a part of the benefit previously derived from the positive pole is destroyed. However, it is well to remember that it can be loosened in this way.

Faradism is rapidly being replaced by the sinusoidal currents, although at times it is of value. It should be taken from an induced primary or secondary current, using a soft iron core magnet which freely gives up its charge. An interrupter is used for this purpose. A movable shield is used to increase and decrease the amount of current going to the patient.

CHAPTER VI

Sinusoidal Currents.

Sinusoidal currents are both slow and rapid. The slow sine current is from 10 to 170, while the rapid is around 1800 alternations per minute. A true sinusoidal current is one of equal phases or alternations—that is, the positive and negative phases are equal, thus eliminating any polarity action.

In the sinusoidal apparatus of the present day these alternations are mechanically controlled. They start at zero and are increased to the desired maximum when they are decreased to zero, the current being reversed on the opposite phase.

There is no distinct break in the current, hence no shock to any part of the nervous system. The gradations are under the absolute control of the operator and may be so slight as not to be noticed by the patient, or strong enough to contract any muscle against the patient's will. And right here it is well to state, and it will be repeated again, always have the patient use his will to enhance the action of the current. In other words, when he feels the current contracting the muscles, he is to use his will power to aid in that contraction, never against it. In this way atrophic and flaccid muscles are again brought under the will of the patient. Slow sine currents are used to re-educate muscles and to rejuvenate the nerve supply of these muscles. Inaction always means decay or disintegration. Action means rejuvenation.

The sine currents are variously controlled; that is, the machine may be set to produce a slow, even sine wave for contraction of muscles, or a rapid sine wave for nerve stimulation, although too rapid for muscle contraction, or both currents may be used at the same time. The machine may be set to produce a surge or a gradual increase and decrease of the sine wave, which is also a very good current.

This surge is from 20 to 340 surges per minute. Moist electrodes are used for this current as for the galvanic current, and when moistened with a sodium-chloride solution the skin resistance is lowered. See that no metal parts come in contact with the skin.

In placing the electrodes for sine currents, it is usually best to place the indifferent electrode over the spinal center of the nerve that is to be used to contract a muscle. The active electrode should be over the terminal nerve filaments or exit of the nerve on the surface or near it. After the indifferent electrode is properly placed and fixed to be retained there by sand bags, bandages, etc., the current should be turned on very gradually until the tol-

erance of the case is reached, then set the rheostat back about 10% of the tolerance, for as soon as the skin is well saturated with the moisture, there will be a lessening in the skin resistance and a definite increase in the current passing through the skin which to the patient will be regarded as an increase of amperage.

Patients receiving sinusoidal treatments should not be left alone. They need the constant attention of the attendant.

The time of a sinusoidal treatment will vary from a minute up to twenty, although the average will be about ten minutes for the entire treatment, even though several nerve terminals may be acted upon during this time. Remember that you are actually exercising a muscle, even though by artificial stimulation, and that the muscle will shortly become fatigued, and over-fatigue is worse than under stimulation. Do not over-fatigue a muscle; always under treat rather than over treat a case, and this applies to all forms of physical therapy. The treatments should be daily until there is definite improvement, then every second day.

In actual practice, the number of contractions per minute should seldom be above twenty, with an average of ten. Be sure and give the muscle a chance to rest between contractions, and this applies particularly to cases which are just beginning the treatment.

The type of cases best suited to sinusoidal therapy are those in which there is partial paralysis of either central or peripheral origin. Where nerves are compressed, this pressure must first be removed. Where centers are destroyed, as in poliomyelitis anterior acuta, do not wait for atrophy but begin using the muscles and stimulating the remaining centers about the third week, or as soon thereafter as you get the case. Old cases, even eight or ten years after the attack, can be benefited, although naturally to a less degree after the parts and muscles become fixed. Chronic poliomyelitis (progressive muscular atrophy) may be temporarily benefited, but it is hardly to be expected that stimulative measures will completely relieve a disease of unknown etiology.

After fractures or dislocations, the sine currents are invaluable to aid in the restoration of function. In these cases all that is needed is stimulation, for very few of them have nerve destruction. In ptosis of the alimentary tract (gastroptosis or enteroptosis) and for intestinal stasis, the sine currents are invaluable and are a definite aid in many cases of uterine prolapse. For the stomach use one pole over the 5th and 7th dorsal vertebrae and the other over the epigastric region; for the colon use one pole over the lower dorsal vertebrae and the other one over the colon in four places, beginning first over the caecum, second over the hepatic flexure, third over the splenic flexure, and the fourth over the sigmoid. The time for each area should be about six minutes, given three times a week.

For the uterus, use one pole over the lower lumbar region and the other pole in the vagina. These treatments should be given for about seven minutes two or three times a week.

Some cases of prolapse of the bowel are also amenable to the sine currents. Use one pole over the upper lumbar region, the other in the rectum. The treatment should be from five to ten minutes in length and given two or three times a week.

For Bell's paralysis begin the treatment at the end of the second week, using the sine currents with one pole over the upper cervical region, the other pole labial over the different motor points on the face. The time of treatment should be three to five minutes three times a week.

The above gives but a few indications for treatment, but these currents can be adapted to many cases and their use is rapidly increasing.

Electrodes, Sterilization of.

The best electrodes for diathermy are made of composition-metal (usually called block tin) in thickness from 22 to 25 and 36 to 40 gauge (B&S).

These can be cut in any size needed to fit each individual case and can be sterilized by boiling. They should not be covered and need not be wet or lathered.

For galvanism and sinusoidal treatments, clay, cotton, or gauze-covered composition-metal electrodes are very serviceable and must be wet, preferably with a sodium-chloride solution.

The newer asbestos rubber-covered pads have many advantages from the point of protection and retention of moisture. On the other hand, they do not always fit the area to be treated even if one has many sizes. Their expense is considerably more than the office-made electrodes. However, the operator should have both kinds and use them where best adapted. The asbestos electrodes should be wet with a sodium-chloride solution. These should also be sterilized by boiling or by special apparatus made for that purpose.

CHAPTER VII

Visible Light.

The term *radiant light* used at the present time is a misnomer and, although it is in general use, we will discontinue it here. Radiant energy properly used would include all infra-red rays, as well as all frequencies, visible and invisible, down through to the last radium gamma ray. Visible light, as we are using it in these pages, means the light rays of the spectrum visible to the human eye, i. e., red, orange, yellow, green, blue, indigo, and violet. With the apparatus now in use to produce these rays, a few of the invisible (infra-red and ultra-violet) rays accompany them, but the quantity and quality are so limited that for practical therapeutic application they may be disregarded. The heat rays are at the red end of the spectrum; the cold rays at the violet end.

The penetrability of visible light has been worked out by Virgil E. Kinney, M. D., of Wellsville, New York. He found that sunlight penetrated more deeply than artificial light, also that visible light rays penetrated the skin of negroes more readily than blonds, and brunettes more than blonds, which is contrary to the usual belief, which is that the dark skins are a natural protection. Thus tanning increases the absorbing power of the skin for visible light. Kinney found that visible-light penetration was from one to one and one-half inches of human tissue.

These humanly visible frequencies (from 7700 to 3900 Angström units) play a very important part in the physiological biology of every day life. That the different frequencies represented by the different colors play an important part in the physical economy is accepted without argument. The exact action of these different frequencies on the different cells of the human body is not definitely known and to determine this action will be the arduous work of real scientists. The effect of color on disease processes, or rather the wave frequencies which produce the color, has not been sufficiently studied.

Colored screens are at times used when giving visible-light treatments and have some value. Red frequencies are the most irritating while the blue end of the spectrum is most soothing to most people. Yellow and green frequencies are the most stimulating to plant and body growth. They lack the irritating qualities of the red and the soothing qualities of the blue frequencies. Gray is neutral and depressing to some people. Bearing in mind the above action, one would expect to relieve a melancholia with red and to sooth a maniacal patient with blue. Cleaves quotes a

Russian physician as stating that the czarist government put their alert, intelligent socialists in rooms where only blue or higher frequencies were allowed to enter. The results were depression of spirit and a benumbing of the mental faculties sufficient to make intelligent, consecutive thinking impossible.

Criminality always seeks the dark, while truth and uprightness always seek the light. The color of our clothing and of our room decorations all influence our attitude toward life and our relations with our fellow beings whether we assume to believe it or not. These color effects should be studied in relation to our patients and to the peoples of various nations. However, keep your feet on the ground. Dark, rainy, or foggy weather contributes to a dull mentality, an increase of germ production and an increase in infective diseases, all of which are soon dispelled by bright sunlight.

Sunlight always has been and always will be a necessary factor in maintaining or regaining health, but it is not always convenient to take sun baths, while visible or invisible light baths can be given in any room equipped with an electric current.

It is now well known that light of all kinds is destructive of all forms of bacterial life. It is nature's universal bactericide. When using visible light, we are using all of the sun's rays except infra-red, and ultra-violet, both of which refer to their position in the spectrum and not to the color. The infra-red rays have a special value as a therapeutic agent. On the other hand, the actinic rays of the shorter frequencies are among the most valuable. While actinic rays are mostly ultra-violet, a therapeutic percentage comes from the visible frequencies at least as far as 5300 Angström units, and Steinmetz insisted that there were chemical rays up into the infra-red frequency, although the quantity is extremely small as compared with the ultra-violet.

The color of the ray depends upon the rate of vibration and the length of the wave which strikes the retina. The humanly invisible frequencies (infra-red and ultra-violet) are such only because our retinas are not capable of receiving and recording these rays or else it is possible that the cornea or lens is opaque to them, thus protecting the retina from damage by them. Steinmetz says that the cornea of the adult human eye is opaque to frequencies shorter than 2950 Angström units, slightly absorbing between 2950 and 3150, but transparent to frequencies between 3150 and 7500 Angström units. He also states that the lens of the adult human eye is opaque to wave lengths shorter than 3760 Angström units and usually to all ultra-violet radiations.

Apparently the lens of the eye of a child transmits slightly between 3150 and 3300 Angström units which is in the near ultra-violet radiations.

Visible frequencies are the best single method we have of relieving pain, and this relief is often possible even in pus cases, although one would be guilty of gross negligence if he treated a pus case long without drainage. Drain your pus case and then use phototherapy to hasten healing by removing blood stasis and flooding the area with good, freshly oxygenated blood. That oxygenation of the blood stream is hastened by light has been scientifically proved (Quinke).

Visible light greatly increases metabolism, acting as an alterant and reconstructant, raising the temperature of the body, and reducing the blood pressure by dilating the surface blood vessels. Physiological processes in the human body are greatly retarded or entirely destroyed by the absence of light; on the other hand, they are destroyed by too much light. Both of these facts are to be remembered when giving phototherapeutic treatments. These are real facts known to every intelligent, observing human being; yet they are usually so far forgotten that they are but infrequently made use of in the treatment of diseased conditions.

Again let me repeat that infra-red rays, visible rays, and ultra-violet rays are obtained from different sources and have different actions. Remember that, no difference what the source of light, if there intervenes a film of glass between it and the object being rayed, ultra-violet rays in any appreciable quantity will not be delivered, for they cannot pass through glass. The portion of the body treated must be absolutely nude.

Visible light has a decided tonic effect, creating a sense of well-being and stimulating nutrition through its action on the sympathetic nervous system. An inactive skin is made intensely active by visible light, and this eliminative action should be increased by the copious drinking of water (ten or more glasses per day) and sufficient outdoor exercise, the latter to be suitably regulated to the need and ability of each individual patient. Acidosis is decreased due to the rapid increase of the alkaline properties of the blood stream.

Sciatica and neuritis are greatly relieved and the case prepared for actinic-ray treatment by the use of visible light. This is also true of anemia, nephritis, and most chronic inflammatory conditions.

Bronchitis and pulmonary congestions are readily relieved by visible light. Keep your bronchitic case under the light for 30 to 60 minutes and repeat daily or even twice daily in severe cases.

Dysmenorrhea sufferers are most grateful for a treatment with visible light. Patients will frequently go to sleep in less than a half-hour, as pain is relieved in about this length of time.

Pleurisy, either dry or with effusion, is rapidly amenable to these frequencies. In fact, the more acute the disorder the more

we are given to using the visible light and the less we use the actinic rays, unless the case be violently infective. We feel certain that every case of chronic constitutional disorder, which is being treated with actinic rays, should first be treated with visible light, for reasons stated below.

We have tried everything from 100 to 1500 watt bulbs, but have finally settled on the 1000 watt nitrogen bulb as the best for general purposes and even the 50 watt bulb is useful where a portable lamp must be used. Our preference of reflectors is the one which gives the greatest number of parallel rays. A focal spot means a hot spot and is uncomfortable to the patient.

Finsen first demonstrated, and many other workers in this field have since proved his statements correct, that most of the actinic rays are absorbed by the blood stream and the sterol products contained in the skin (Steenbock). While we know this to be true, we also know that some of the rays coming from the quartz mercury-vapor lamps will fog a film through several inches of tissue. But granting the known fact that most of them are absorbed, how are we to get the blood where it can be acted upon by actinic rays to the best advantage? Our method, which we have quoted throughout this book and which we have used for years, is to precede the actinic-ray treatment with a visible-light treatment of from ten to forty-five minutes, average twenty minutes. This dilates the surface capillaries and brings large quantities of blood to a point where it can be reached with the least difficulty by the actinic rays; meanwhile blood, both arterial and venous, and lymph stasis are being relieved and their products removed by the action of the visible light. This gives the actinic rays a better opportunity to destroy infections within the tissues, for the bacteria are more readily reached and the more directly the actinic rays can come into contact with the bacteria, the greater is their bactericidal power.

Sunlight and visible light (to a less degree) are destructive of infections, but both to a less degree than ultra-violet rays artificially produced. On the other hand, the visible frequencies are much more soothing than the actinic rays, while the combination makes an almost ideal treatment for most infections and painful disorders.

We would not even venture the suggestion that a pus appendix, gallstone colic or a nephrolith should be treated by either actinic rays or visible light, and yet we have seen many a classic symptomatic case of appendicitis, or cholecystitis clear up under their use and a pyonephrosis without nephrolith that had resisted months of treatment by drugs, both internal and injected into the pelvis of the kidney through the ureter, improve almost from the first treatment by the combined use of actinic rays and visible light.

While conscious of the above facts, we are, however, *going to keep on repeating the fact that actinic rays and visible light are not cure-alls and cannot be used by every layman to treat every named disease with the hope of curing it, but that they must be used with intelligence and with more than just common sense.* They must be used by those having an intimate knowledge of physiology and pathology, that they may know their limitations; and we wish to add, on the other hand, that the knowledge of their limitations must come from experience and not from prejudice, so when we say that sprains and bruises can be relieved in one hour's time and the patient returned to his occupation in one-fifth of the time it would take with splint treatment, you will not be willing to condemn without a knowledge of the real facts in the case.

When we say that actinic rays preceded by visible light are the best treatment for osteomyelitis, do not neglect to give us credit for a sufficient knowledge of pathological processes to know that the case should be drained or a sequestrum removed; but after drainage or the removal of a sequestrum what would you do with the case? Here is where common sense and a knowledge of phototherapy are invaluable, and if used will hasten the healing processes of nature and your case of osteomyelitis will bless you for this additional knowledge in addition to your surgical skill. We have taken cases of this character and relieved the pain and hastened the healing after the surgeon had operated repeatedly. Operated only to tell the patient that he must reoperate or amputate, as there was nothing else to do. There is something else to do, and if the practitioner of medicine will not do it, then he has only himself to blame if the layman takes it upon himself, even in his ignorance of pathology, to learn of a better way.

We are not trying to build up a new school of therapy. What we are saying is so old that it is a shame that it needs to be said at all. It is so self-evident with the least thought that we wonder why we have been so slow to take up this line of work.

Visible-light treatments are given with the part being treated exposed directly to the rays and at a sufficient distance from the lamp to avoid discomfort or irritation, or, put in another way, close enough to the lamp to be comfortable.

The length of treatment should be fixed by the results obtained. To dilate the capillaries, a period of ten minutes is usually sufficient for each surface, after which the actinic-ray treatment is given. When used alone for bronchitis, the treatments should be of sufficient length to relieve the distressed breathing, which usually requires from thirty to sixty minutes; for lumbago, twenty to forty minutes; for sinus infections, thirty to ninety minutes; for pleurisy, thirty to sixty minutes; for dysmenorrhea, thirty to sixty minutes; to activate the skin, forty-five to ninety minutes and so

on through the list of diseases which are alleviated by these rays. The average treatment is about twenty minutes. They range from ten to sixty in all but a few exceptions, when this time may be doubled.

In frequency the treatments are usually given once daily or every other day, although in severe cases they may be given twice daily or continuously. When used continuously, the 1000 watt bulbs must be six or more feet from the part being treated.

CHAPTER VIII

Bath Cabinet with Quartz Lamp.

In 1895 Margaret A. Cleaves of New York City used her first electric-arc bath cabinet. It was six feet long, two and one-half feet wide and seven feet high, built into one corner of her office. It had an observation window which could be used for ventilation when desired. It was lined with zinc which was painted white. A carbon-arc lamp of 2000 c. p. was suspended from the ceiling at each end of the cabinet. Mirrors reflected the light rays upon the patient. The patient reclined upon a cot while taking the treatment.

Finsen about this same time built a circular room thirty-seven feet in diameter in the center of which he suspended two arc lamps of one hundred amperes each at a distance of six feet from the floor. The room was divided radially by means of partitions, thus securing privacy. In these small rooms the patients reclined nude while taking their treatments. These were light baths pure and simple, as no heat from the arc lamps reached the patient. From these arcs, the patient received almost complete sun spectrum, which includes 80% infra-red, 13% visible, and 7% ultra-violet frequencies. The length of exposure varied from ten to sixty minutes. These treatments were given to cases of anemias, asthma, bronchitis, eczema, influenza, neurasthenia, neuritis, tuberculosis, and acute catarrhal conditions.

In the electric-arc baths, there is no element of depression either during or after the treatment.

Kellogg's first incandescent light cabinet was a metal reflector about two feet wide and six feet long which supported thirty incandescent light bulbs of sixteen candle-power each and which could be raised and lowered at will. The treatment was given with the patient reclining.

The modern bath cabinet is quite different, being built on scientific lines with refinements to meet the needs of various physicians in the treatment of various diseases. First, it is constructed of steel and properly ventilated; second, it contains forty-eight 60-watt tungsten bulbs for heat and elimination; third, it is equipped with rhythmic generator for the regulation of the amount of light to be used as well as the frequency of its application; fourth, in it is installed a quartz mercury-vapor burner.

The first means that it is fire proof and that the wiring has been passed by the National Board of Underwriters. The ventilation is under control of the operator.

Second, that it contains enough light for all purposes and the bulbs are wired in blocks of six, regulated by several control switches, so that any part of the body may be treated and as little or as much light used as is needed for the particular case at hand.

Third, the rhythmic generator gives the tissues a mild passive massage during the entire treatment and vaso-dilation with its coincident brain anemia is prevented, for the blood vessels are alternately dilated and contracted without in any way interfering with the active elimination constantly in progress at high temperatures. The water loss may amount to several pounds in the course of a treatment which is from five to thirty minutes.

Fourth, with the quartz burner installed within the cabinet, one has an ideal capillary dilation for the administration of actinic rays. This dilation is maintained during the actinic-ray treatment by turning off only the lights in the half of the cabinet occupied by the quartz burner. In this way there is no conflict of frequencies and there is a gradual reduction of the maximum heat so that the patient is ready for a rub down and his clothing at the end of the actinic-ray treatment. The quartz burner is so arranged that it can be raised and lowered during the treatment without opening the cabinet.

Fifth and last, but not least, it is built so the patient is completely exposed to the different frequencies, except the head and face, during the entire treatment, thus getting the maximum of benefit with a minimum of personal exposure. The upright position is the only one which completely exposes the body. With the reclining cabinets only one-half of the body is exposed to the light rays at one time. While it is true that some cases unable to sit up may be treated in a reclining cabinet, they are so few in comparison with those who can, that we prefer to start these cases with two 1000 watt bulbs suspended over the patient. In this way, we can regulate the distance of the bulb from the patient and need not move him from his bed. As soon as there is sufficient improvement, we start the cabinet treatment knowing that improvement will be much more rapid. From the operator's side, the treatment is very much shorter, as well as more effective.

Our average technique for giving these treatments is as follows (varied of course to suit the individual case): turn on the incandescent bulbs and warm the cabinet to 85 degrees F., cover the floor, stool, and collarette with bath towels, place the patient so that the head is free both laterally and perpendicularly, close the collarette with the bath towel between the patient and the wood for two reasons, sanitation and the avoidance of intense heat contact when the wood becomes hot toward the end of the treatment. Gradually increase the temperature until the thermometer within the cabinet registers about 100° F. Now start the rhythmic gen-

erator at the speed desired, usual interruptions twelve to sixteen per minute, which is maintained during the balance of the eliminative part of the treatment. When elimination is at its height, usually in from three to fifteen minutes, we turn off the bulbs on the quartz half of the cabinet and ask the patient to start turning very slowly and continue this motion. The quartz burner, which starts automatically with the switching in of the street current, is switched in about five minutes before the finish of the eliminative treatment. For the very short treatments, it is switched in when the patient enters the cabinet. The actinic rays are given for one to ten minutes, average six minutes, during which time the patient turns on the swivel stool from five to ten times. In this way, all parts of the body and limbs are exposed to the actinic rays. There is no need of turning during the first or eliminative part of the treatment, as the light bulbs are on all sides of the cabinet.

If stimulation is desired, the treatment should be short and sharp. Have the cabinet heated to about 130° F. and then have the patient remain for two or three minutes, followed by about one minute of actinic rays, ventilators closed.

If sedation is desired, keep the temperature down around 100° F. for ten to twenty minutes, followed by actinic rays for one or more minutes, according to the number of treatments taken. Use rhythmic generator with prolonged "off." Have ventilators wide open.

For elimination, the most beneficial of all uses of the bath cabinet, start the treatment with a low temperature—about 90° F. Have all the lights on and all ventilators open. As the cabinet warms up, start the rhythmic generator long "on," short "off." When the temperature reaches 120° F., close the ventilators, but keep the rhythmic generator going. Run the temperature up to 140° or 150° F. In some cases continue the treatment as long as the patient will tolerate it, usually ten to twenty minutes. We have given them as long as forty minutes, although the patient's general condition must be fairly good to stand that length of time. Be exceedingly careful in giving these treatments to patients with cardiac disease.

During this treatment have the patient drink freely of cold water or cold lemonade or orangeade, usually six to ten glasses in thirty minutes.

With the rhythmic generator going there is but slight danger of brain anemia. Finish the treatment with as much actinic rays as the skin will stand without blistering.

The electrical wiring requires a No. 8 and it should be fused to 40 amperes to take care of the incandescent bulbs and the quartz-mercury burner at the same time.

The clinical field covered by the bath cabinet is about in the following order: Simple asthenias (especially if secondary to auto-intoxication or low-grade infection) arthritis, nephritis, tuberculosis (except advanced cases), bronchitis, infections (particularly chronic), secondary anemias and some cases of neuritis.

CHAPTER IX

Physics of Actinic Rays.

Living organisms of all kinds are dependent for their existence upon the radiant energy of the sun.

The chlorophyl system of green plants is a most important photo-chemical reaction because it stores up light energy in a convenient form so that it may be used by the higher animals. On the other hand, it restores to the atmosphere the products of oxidation of animate beings.

Every element in nature absorbs light energy which, to an unknown extent, is retained and utilized. Elements which are opaque to certain wave lengths either absorb or reflect that particular wave length. The light energy thus absorbed may then be utilized for various purposes, as heat, growth, catalytic action, chemical or electrical changes.

Grotthus' law, published in 1819, is "Only the rays absorbed are effective in producing chemical change." The amount of light absorbed by any given substance is equal to the difference between the amount of light which entered that substance and the amount passing through it. All substances absorb light rays in different degrees of quantity and of wave length.

The depth of penetration of a definite wave length varies with the power of the substance to absorb that particular wave length. Absorption necessarily means the stopping of the wave, thus limiting its penetration. Conversely all wave lengths which pass through a substance are not absorbed. All light frequencies are reflected until absorbed and are then converted into other energies. Snow reflects from 80% to 90% of the ultra-violet frequencies, hence the readiness with which we acquire snow-blindness on bright winter days.

Chemical molecules have definite rates of vibration, therefore will absorb only their rate of vibration or wave length from any source of light energy regardless of how many other wave lengths are issuing from the same source at the same time. It must follow then that the remainder or unabsorbed wave lengths must be either reflected or have power to penetrate that particular molecule. The absorbed wave lengths may be sufficient to start a catalytic action or they may produce an immediate chemical change in the molecule, particularly if the wave length is below 5300 Angström units.

As definite molecules have definite rates of vibration and absorb definite wave lengths of light, these absorbed wave lengths

are known as absorption bands and for a given element are always of the same Angström unit of wave length.

Photo-chemical changes due to light absorption are but slightly affected by different degrees of temperature.

Fluorescence and phosphorescence are cases of photo-chemical reactions with the storage of light energy when rayed with actinic frequencies. Fluorescent elements immediately give off their light of longer wave length than that absorbed, while phosphorescent elements store the light energy for longer or shorter periods of time depending upon the elements rayed. Radiant energy, either visible or invisible, of one wave length does not always harmonize and is not always synergistic with other wave lengths either visible or invisible.

Fluorescent wave lengths emitted are always longer than those absorbed. Tappeiner in 1905 found that albino animals fed buckwheat and subsequently exposed to sunlight died within a short time. He also found that colored animals were not affected under the same conditions. He also found that alcohol extracts a fluorescent dye from buckwheat. If this extracted dye was fed to albinos, they reacted to light as though they had been fed the buckwheat. Many others have observed the same sensitization.

Becquerel and Seebeck discovered that yellow and red rays counteract the action of the frequencies at the violet end of the spectrum.

L. Oppenheim (*Revue de Medecine*, Paris, 41: 281-344, 1924) claims that the infra-red rays counteract the ultra-violet rays.

Cleaves says: "From a study of the physical effects of light, we find that absorption is a most important phenomenon of light energy. The appropriation and selection of waves by matter and their eventual return to space constitutes the life of the universe. None of this absorbed light is lost." However as far as known, all radiative energy is synergistic with drug action. Calcium and inorganic phosphorus metabolism is stimulated by the action of ultra-violet rays. This has been scientifically demonstrated by Hess and McCollum at Johns Hopkins.

When various bodies are heated they begin to give off the long infra-red rays first, but as the temperature increases the shorter wave lengths are brought out. As an example, if iron is heated, first the infra-red rays can be felt as heat although not visible, then as the temperature rises the visible red rays appear followed by the yellow and blue until the full spectrum is visible as white rays or as this phase is commonly called white heat. To this extent heat and light waves coincide. It is well known that light waves can be produced without heat in any appreciable quantities. This action is known as chemi-luminescence (Trautz 1905).

Chlorophyl absorption of light rays is greatest around 5000 Angström units and reaches a maximum between 6500 and 6660,

with some absorption at 6780 and 6850, and some between 4800 and 4000, but very little below 4000 Angström units in the ultra-violet. In this instance the light energy is retained. LeBon claims infra-red frequencies destroy chlorophyl. Vegetable life is not possible without light as light is necessary for chlorophyl assimilation and as given above, the frequencies necessary are in the red, orange, blue, indigo, and violet regions.

Starch synthesis in the green leaf is greatest in bright sunlight. The leaf at this time may contain as much as 6.44 per cent of the dried leaf, while at night it may drop as low as 0.38 per cent (Burns). Burns also states, "Cane sugar is found and can be detected before starch can be found, and it is generally present in greater amounts, 7.63 per cent to 2.63 per cent of the dried-leaf weight. Other sugars are present in small variable quantities."

Burns sums up in the following statement, "Man obtains the energy necessary for his maintenance and for the performance of physical work from the disruption of proteins, carbohydrates and fats, synthesized in the first instance by green plants which trap and store solar energy. Historically and until quite recently, the energy of sun light, apart from an insignificant amount drawn from the tides, was the sole income of energy available for the world."

The use of actinic rays is both old and new. So long as the earth has been, there have been actinic rays with their health-giving properties. Those coming from the sun meet many obstacles on their journey to the earth's surface, for dust and smoke are opaque to them.

The National Institute of Medical Research of London records the fact that there are more actinic rays in the "sky shine" or from the sky than from the sun direct. This is important for in cases, which for any reason, cannot be exposed direct to the sun's rays can be exposed to the actinic rays from the sun in the sky-shine. Even then it is necessary that their bodies be nude and in the open air for actinic rays will not penetrate glass or clothing.

Actinic rays were first discovered by Ritter in 1801.

In 1858, Charcot reported several cases of electric light burns (See *Compt. Rend.* 10D:63, 1858) where the eyes were badly inflamed although the individuals were too far from the light to experience any heat. He, therefore, concluded that the erythema was due to a chemical action of the light rays. No use was made of the findings.

The first definite study of the destructive action of light rays on bacteria came with the theory of germ life itself. In 1877 Bownes and Blunt (*Proc. Roy. Soc. London* 26:488, 1877) reported the results of their experiments of the destructive action of light upon bacteria. They showed that the violet end of the spectrum was more destructive of bacteria than the red end. They also

proved that light will kill bacteria in distilled water proving thereby that water is not opaque to light rays.

Duclaux was the first to study the action of light upon pure cultures of bacteria. His first experiments were upon anthrax bacilli. He found that the culture medium influenced the action of the light and that some species were more affected than others.

In 1887 Roux found that when his culture media was exposed to sun light, it became toxic to anthrax bacilli. Bovie in January, 1916, found that ultra-violet frequencies did not produce any toxic substance in the solution rayed.

Ward in 1892 experimented with the relative toxicity of the various parts of the spectrum using a carbon arc for his source of light and found that the bactericidal action began at about 5000 Angström units and extended into the ultra-violet. He suggested that disinfection of rooms might be possible with rays from an open carbon arc.

Bernard and Morgan (British Med. Jour. Nov. 14, 1903) were first in a series of experiments made to differentiate, if possible, the bactericidal frequencies of the spectrum from those which excite a reaction in living tissues and were only partially successful. They did, however, find that the bactericidal action was confined almost entirely to the violet end of the visible spectrum and to the ultra-violet region. They decided that the most active bactericidal rays lay between 3200 and 2200 Angström units in the near and middle ultra-violet regions of Luckiesh.

The bactericidal action is probably confined to the actinic or chemical rays in the lower end of the visible spectrum and in the upper end of the ultra-violet regions.

Tissue reactions come from the ultra-violet region although the exact frequencies have not been determined. Bactericidal action is directly proportionate to light efficiency.

While the question of bactericidal action is not paramount, the ability of the same frequencies of the spectrum to excite intense tissue reaction is the basis of their therapeutic application.

The blue, violet, and ultra-violet frequencies possess the least, while the green, yellow, and red frequencies have the greatest penetrative power. When we know that light energy is destructive of bacterial life, it behooves us to flood our house with sunlight at least for a portion of each day and to protect ourselves as well by the beneficent action of light and from the destructive frequencies of the long heat rays and the very short gamma rays. Climatization to bright sunlight is absolutely necessary to prevent harmful effects.

Sun baths are as old as history, for the Egyptians and Romans treated various diseases by exposing their patients to the sun's rays; but only in recent years has man endeavored to get a pure

actinic-ray bath by going above the dust and smoke and taking his sun bath on the side of a permanent glacier, where the results of such a sun bath were found to be marvelous. This form of treatment was perfected by Rollier of Leysin, Switzerland, where, in 1903, he established sanatoria at an altitude of four thousand feet. Here patients were exposed nude to the sun's rays. The length of exposure was carefully regulated by its effect upon the individual, for with sun baths one has to deal with the large proportion of infra-red rays (80%) which are heat producing not only on the surface, but of the deep structures, as these frequencies are very penetrating and when absorbed are converted into heat energy. However, only a comparatively small number of people can go to a glacial resort so man has tried to perfect an apparatus to take the place of the glacial sun bath, and the nearest approach to it today is the quartz-mercury-vapor and carbon-arc lamps.

Finsen in 1893 was the first (though Widmarck used rock crystals in 1889) to demonstrate in a scientific manner the value of the actinic rays, but his method of producing them was too expensive to make their use popular, so it has remained for the present generation to perfect an apparatus which would produce them at a nominal expense, thus popularizing them.

Finsen is authority for the statement that the blood in the capillaries absorbs most of these rays, hence their inability to penetrate deeply is not a handicap, for if we can influence the blood stream we can influence any and every tissue in the body. Steenbock and McCollum have demonstrated that the sterol products of the skin are active absorbents of ultra-violet frequencies. Finsen also showed that light from a carbon arc will penetrate bloodless tissue much further than it will tissue in which blood is flowing, which proved the absorbent power of the blood stream for all frequencies from the long infra-red to the ultra-violet.

Quoting from W. T. Bovie (*Botanical Gazette* Jan., 1916), "It is worth while to consider in some detail the method used in the practice of Finsen's phototherapy. A carbon arc, carrying 50-60 amperes, is used as a source of light. Previous to 1901 sunlight which passed through a concentration was used for treating the patients. Its use was abandoned because, aside from the uncertainty of weather conditions, it was found that sunlight is not only weak in the extreme ultra-violet region (the therapeutically effective part of the spectrum) but it contains an abundance of light in the blue-violet region. The blue-violet waves so tan the skin that after one or two treatments the deposit of pigment makes further treatment impossible. The carbon arc, on the other hand, emits light of shorter wave lengths than those found in sunlight. These short light waves have a marked action upon the surface layers of the skin. They destroy many of the epidermal cells, including

those which contain the pigment. The skin, therefore, becomes more transparent with each successive exposure, and hence there is a continual increase in the penetration of the light.

"Experiments were made with light sources which emit a relatively greater amount of light in the extreme ultra-violet than is emitted by the carbon arc, but it was found that there was no increase in the therapeutic effects, while there was an undesirable increase in the amount of destruction of the epidermal cells."

Steinmetz, *Radiation, Light, and Illumination*, Page 59, states: "In sun burn we probably have two separate effects superimposed upon the other; that due to the energy of the solar radiation, and the specific effect of the high frequencies, which to a small extent are contained in sunlight. The two effects are probably somewhat different and the high-frequency effect tends more to cause inflammation of the tissues, while the energy effect tends toward the production of pigmentation and the symptoms of sun-burn thus vary with the different proportions of energy radiation and of high frequency radiation as depending on altitude, humidity of the air, the season, clouds, etc. The action of radiation on living organisms is stimulating if of moderate intensity, destructive if of high intensity.

"The destructive action depending largely on the amount of light to which the organism is accustomed. Men have lived for ages in the light and the cells of the human body are far more resistant to light than disease germs which for ages have lived in the dark.

"Thus by exposing the diseased tissue to high-frequency radiation, the disease germs are killed, or so far damaged that the body can destroy them, while the cells of the body are unharmed, indeed are stimulated to greater activity in combating them."

Herein lies the scientific application of radiation therapy—to use a sufficient intensity and duration to kill or damage the bacilli, but not so intense as to harm the cells of the body.

Jansen has demonstrated that the actinic rays may kill bacteria at a depth of two inches in soft tissue. Our own experiments (see Plate XII immediately following) prove that the rays from the quartz mercury-vapor lamp will fog a photographic plate through a living body weighing one hundred and sixty pounds, and from the fairly even distribution of the light rays upon the exposed plate, it is evident that they penetrate bone as well as soft tissue although these are not of the short ultra-violet frequencies.

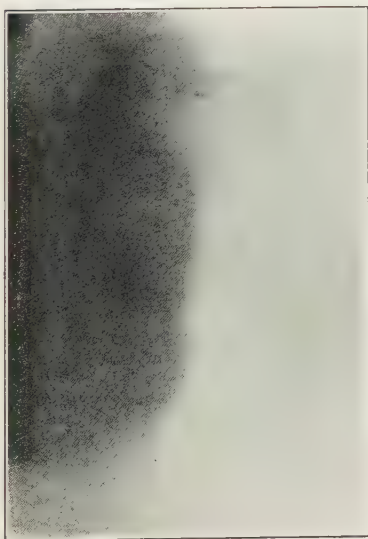
Remember that actinic rays from the quartz mercury-vapor lamps are constructive, differing therein from X-rays and radium gamma rays, which are destructive of normal as well as of diseased tissue. Remember also that actinic rays are positive, therefore discharge a negatively electrified body. This was first reported by Hallwachs (1888) when he noticed that a negatively charged, insu-



No. 1 (Chest)



No. 2 (Abdomen)



No. 3 (Abdomen)



No. 4 (Hand)

Showing penetration of rays from quartz mercury-vapor lamps.

Plate XII

lated metal, such as a gold-leaf electrometer, loses its charge when illuminated with actinic light. He states, "This appears to be a case analagous to those in which light energy is stored, since the light energy is changed into the kinetic energy of moving electrons shot from the metal."

Next to fluorspar, quartz allows more actinic rays to pass than any other known substance. These rays are very short, not over 6000 Angström units and running down to 1860 Angström units. Below this fluorspar and a vacuum must be used. Schumann carried his experiments down to 1000 Angström units by the use of fluorspar. More recently the spectrum has been pushed to 905 Angström units by Lyman and W. T. Bovie of Harvard University. Millikan (Institute of Technology, Pasadena, California) studied the extreme ultra-violet region below 917 and in 1920 was able to extend the spectrum to 200 Angström units thus connecting the frequencies of 905 Angström units, plotted by Lyman and Bovie, with the L series of the X-ray region of the spectrum.

Luckiesh in "Ultra-violet Radiation" (1922) divides the ultra-violet wave lengths from 3900 Angström units to ∞ into three general regions: for wave lengths from 3900 to 3000 Angström units he designates as the near ultra-violet, for those from 3000 to 2000 Angström units he designates as the middle ultra-violet, while the remainder from 2000 to ∞ which includes both X-rays and radium, he calls the extreme ultra-violet.

Bovie states (Botanical Gazette, Jan., 1916): "As pointed out by Löbel long ago, the biological effects of exposure to light are the result of photochemical action. Hence if we are to obtain a clear understanding of the biological action of ultra-violet light, it will be necessary to consider some of the characteristics of photochemical reactions.

"Photochemical action necessitates light absorption, although all light absorption is not accompanied by photochemical action. Since, for substances in general, light absorption increases as the wave length decreases, chemical action also increases as the wave length decreases; and, as pointed out in the pioneer work of Downes and Blunt, the destructive action of light upon protoplasm increases as the wave length decreases.

"There is evidence for the supposition that the chemical characters of some of the elements are changed when they are acted on by ultra-violet light. For example, when oxygen is acted on by light of short wave length ozone is formed; that is, ozone is more stable in such oxygen than it is in ordinary oxygen. In passing, it may be pointed out that this fact is of particular interest to the biologist, for ozone is more opaque for short light waves than is molecular oxygen, and it seems that life on earth is possible only because the ozone formed in the upper layers of the atmosphere

by the ultra-violet of sunlight serves as a light-filter and protects the organisms on the surface of the earth from these shorter and more destructive rays. Chlorine may be mentioned as another more destructive example. In this case, not only are the chemical characters of the atom changed, but according to Trautz the specific heat as well.

"In consequence of the fundamental nature of the changes produced by the light, it is often found that many compounds containing the same element are photosensitive. For example, light affects many of the compounds containing silver. Protoplasm contains many photosensitive elements, and it is found that protoplasm and a large number of the substances elaborated by protoplasm (sugar, cellulose, chitin, hair, rubber, etc.) are decomposed when exposed to ultra-violet light.

"The temperature coefficient of light reactions is very low. For photochemical reactions, therefore, temperature has but little influence upon the speed of the reaction. Photochemical changes may take place in dry materials or in a vacuum. The writer has found that the time required to kill spores of fungi was the same, whether the spores were exposed while in a very high vacuum or while in the air and turgid with imbibed water. This result is most surprising in view of what we know of biochemical reactions, all of which take place in aqueous media.

"Dryer and Hanssen showed that albumins and globulins were coagulated when exposed to ultra-violet light, and the writer, by an investigation of the temperature coefficient of the reaction, showed that light coagulation, like heat coagulation, involves two reactions: (1) a chemical change in the albumin and (2) the precipitation of the albumin. He showed that the first reaction has a very low and the second a high temperature coefficient.

"Henri determined the coefficient of absorption of egg white and found that there is a close parallelism between the absorption by the albumin of the various wave lengths and their destructive action.

"A very important phase of the biological effects of light is to be found in connection with the action of the so-called photodynamic substances. The reader is referred to a summary of this subject by Tappeiner, as space does not permit a discussion of it here.

"The writer has found no published record of previous investigations on the visible effects of the Schumann rays upon protoplasm. Several investigators, however, have made microscopic studies of the visible changes produced in protoplasm by light of longer wave lengths. For the most part such studies have dealt with the effects produced in the tissues of higher organisms, and secondary physiological changes have not been sharply distinguished from the immediate effects of the light. Dreyer and Hertel have studied the visible effects of ultra-violet light upon unicellular

organisms, but neither of these investigators used light which contained the Schumann rays."

Quoting further from Bovie, "It is evident, therefore, if we wish to expose organisms to the entire Schumann spectrum we can have no substance other than fluorite between the organism and the source of light."

In these experiments Bovie found that the action of the Schumann rays were additive and that infusoria were very quickly cytolyzed by the rapid vibrations of these ultra-violet rays. He also found that the ultra-violet rays did not produce any toxic substance in the solution rayed and for the time and distance of his experiments. The rays were found to be very destructive to protoplasm and the conclusion drawn was that "we are dealing with a powerful cytolytic agent."

Arthur Schuster, Professor of Physics in the University of Manchester (1888-1907), says regarding actinic rays, "Although the vibrations in the infra-red have considerably greater intensity, they are more difficult to register than those in the ultra-violet.

"It has been denied by some that pure thermal motion can ever give rise to line spectra, but that either chemical action or impact of electrons is necessary to excite the regular oscillations which give rise to line spectra. There is no doubt that the impact of electrons is likely to be effective in this respect; however, it must be remembered that all bodies raised to sufficient temperature are found to eject electrons, so that the presence of the free electrons is itself a consequence of temperature. The view that visible radiation must be excited by the impact of such an electron is, therefore, quite consistent with the view that there is no essential difference between the excitement due to chemical or electrical action and that resulting from sufficient increase of temperature."

Whether the actinic rays absorbed by the blood stream and the sterol and other substances in the skin excite chemical, electrical, or thermal action, it is probable that electrons are developed which, when coming in contact with the substances within the blood stream, are productive of constructive effects or of definite chemical changes which are as yet unidentified. The wave lengths from 1000 to 200 Angström units have but slight penetrability, while from 200 Angström units down through the X-ray and radium frequencies are extremely penetrating—increasing as the wave length decreases. The comparative penetrability of alpha, beta, and gamma rays of X-ray and radium is respectively one, one hundred, and ten thousand.

Gamma rays travel in a straight line only and are, therefore, destructive. They are of great penetrative power and cannot be deflected, whereas the longer actinic rays from the quartz or carbon arcs are readily reflected, refracted, polarized, absorbed, or deflected and are, therefore, not destructive. In other words in the

actinic region, the shorter the wave length the greater the penetration. The converse is also true in the red end of the spectrum where the longer the wave length the greater the penetration. This change takes place in the green-blue region of the visible spectrum.

The actinic rays are invisible to the naked eye. They are known as the cold rays, for quartz filters out the red, orange, and most of the yellow rays which are the heat-producing rays, also some of the green and blue rays. For the production of the heat rays, we use a 1000-watt bulb which does not give off actinic or chemical rays in any practical quantity. The actinic rays which produce erythema solare, or sunburn, are also the ones which destroy bacteria and are found in the middle ultra-violet region between 3000 and 2000 Angström units, and it matters not whether they come from the sun whose lower limit is 2900 or are produced artificially. The production of sunburn is greatest between 2350 and 2500 Angström units while the frequencies having greatest bactericidal action lies between 2380 and 2940 with the maximum between 2540 and 2800 Angström units. Most of the tanning of the skin is done by the blue-violet frequencies from 3900 to 5000 Angström units.

An exposure of bacteria for three and one-half hours proved that the limits of the principal bactericidal action are between 2150 and 2960 Angström units or the middle ultra-violet region. Wave lengths between 2960 and 3800 Angström units did affect bacteria and were found to penetrate human skin to appreciable depths. Wave lengths between 2100 and 2960 Angström units are absorbed by the superficial layers of human skin.

The bactericidal action from the sun is positive although much slower than that artificially produced because of the longer wave length, the lower limit being 2900 Angström units.

The rays coming from a quartz lamp are principally of the higher frequencies, as only a few of those above 4040 Angström units (the violet visible band) are developed. These higher frequencies are destructive of all forms of bacterial life (and this has been scientifically proved as far back as 1877 by Downes and Blunt) both by direct rays and indirectly by their action upon the blood stream, body tissues, skin products, and protoplasm.

Verhoeff and Bell (Proc. Am. Acad. Arts and Sciences 51, 1916, 637) used a 220 volt 3.5 ampere quartz mercury-vapor burner for testing the amount of energy radiated in the various regions of the spectrum, first filtering out the infra-red rays with water. They found that the remaining energy was 35% in the visible frequencies and 65% ultra-violet distributed equally in the near and middle ultra-violet regions.

These lamps undoubtedly generate some rays in the ultra-ultra-violet region which is known as the Schumann band of the spectrum, although probably in a limited quantity; but who shall

say that they are not sufficient in number to produce a therapeutic effect?

Henri in 1912 measured the relative destructive action of light of various wave lengths. He used as sources of light a mercury-vapor arc in quartz, and spark gaps with cadmium and magnesium terminals. The relative intensity of the light of various wave lengths was measured by the effect upon a photographic plate. He made use of screens for filtering out the various wave lengths. The efficiency of the screens was determined by spectrographic methods.

The rays coming from a quartz lamp are principally of the higher frequencies and only a few of them, by comparison, above 4040 Angström units (the visible violet band) are developed. These higher frequencies are destructive of all forms of bacterial life both by direct rays and indirectly by their action upon the blood stream, body tissues, and upon protoplasm.

LIGHT REGIONS

	Angström Units	
High frequency	1 to 3	trillion
Infra-red, extreme	00 to	500000
Infra-red, middle	500000 to	20000
Infra-red, near	20000 to	7700
Visible	7700 to	3900
Ultra-violet of sunlight.....	3900 to	2900
Ultra-violet from quartz.....	3900 to	1860
Ultra-violet from fluorite.....	1850 to	905
Schumann Band	1850 to	1250
Lyman and Bovie Band	1250 to	905
Millikan Band	905 to	200
X-ray K.L. and M. series.....	200 to	12
X-ray (therapeutic)	12 to	0.2
Radium	3.5 to	0.07
Cosmic (Millikan)	0.07 to	0.0035

This table was made from the best authorities available.

See Frontispiece.

Bovie states, "These differences in absorption which are very slight, if they exist at all, in the infra-red and red and of the visible spectrum are more pronounced in the violet and become more and more pronounced the further we go into the ultra-violet. In the ultra-violet, at wave length 2800 Angström units, not only is the nucleus, which is distinguished from the cytoplasm with some difficulty in the visible part of the spectrum, very clearly delineated, but various nuclear structures, such as chromosomes, may be identified as well. A shift of 50 Angström units further into the ultra-violet brings out the details of protoplasmic structure.

"The stimulation of amoebas by the products of cytolysis by ultra-violet light is a phenomenon of much biological interest. It

is difficult to resist the thought that when applied to the normally phagocytic cells of higher organisms this method of stimulation may lead to results of therapeutic value."

William Maddock Bayliss, in "Principles of General Physiology," 1915 (Longmans, Green & Co., 4th Avenue and 30th Street, New York City), makes the following statement: "The greater number of the constituents of living cells are colorless; that is, they do not absorb rays of the wave length of visible light, many of the structures of living cells, however, absorb ultra-violet light, so that it is not surprising to find that, as a rule, radiations of this kind have a very powerful effect on them.

"The use of the absorbing power for ultra-violet of some constituents of living cells for the purpose of photographing them has been referred to, as also the use of the fluorescence excited in them by the ultra-violet light absorbed.

"A series of important researches on ultra-violet light is at present being carried on by Victor Henri with several coadjutors, the results of some of which have been published. (See Mme. V. Henri, Victor Henri, J. Languier des Bancelles, and R. Wurmor, 1912.)"

Mme. Henri makes the statement that the destructive effect of actinic rays upon bacteria increases in inverse ratio to the length of the waves down to 2140 Angström units as far as she had tested, and from experience there seems to be no doubt but that this destructive effect increases down to 1000 Angström units (the ultra-ultra-violet band of Schumann) and beyond. This destructive effect applies not only to bacteria and diseased tissues, but when we reach the region of the roentgen and radium gamma rays these short rays are destructive of normal tissue as well."

The region from 1860 Angström units to 905 Angström units has been studied by Lyman and Bovie of Harvard University and some of their findings are recorded above, so gradually the many problems concerning ultra-violet frequencies are being solved. More recently (1920-21) Millikan has plotted the region from 905 to 200 Angström units but no work has been published on the usefulness of this region.

Bayliss further states: "A remarkable fact is that the excitability to ultra-violet is independent of temperature, a fact which shows that the exciting cause of the reflex movement is a photochemical reaction whose products, no doubt, excite receptors of some kind in the outer surface of the animal."

Nature (April 16, 1908, page 570) makes the statement that the animal body has organs which are stimulated by the radiating energy of light and heat; others are stimulated by chemical particles drifting from odorous objects; others by objects mechanically touching the skin, and that these organs so especially adapted to

environmental stimuli are called receptors. Attached to these receptors are nerves which transmit to brain centers the impressions thus obtained.

Rep. Brit. Assn. Advancement of Science, 1902, page 778, says: "A receptor being a molecular complex of a cell through the union with which alien cell products or cell constituents can produce their specific effects upon the cell, it stands to reason that in a photochemical reaction, the products of which excite these receptors, we have at hand a method of producing immunity of unsolved possibility."

Ehrlich's hypothesis to explain the action of a receptor is usually spoken of as the side-chain theory of immunity. He considers that the toxins are capable of uniting with the protoplasm of living cells by possessing groups of atoms like those by which nutritive proteids are united to cells during normal assimilation. He terms these haptophor groups, and groups to which these are attached in the cells he calls receptor groups.

These receptor groups in any living cell have the power to assimilate into its protoplasm any chemical substance available. This absorption is due to the receptors or to the presence of unsatisfied molecules. The normal cell depends upon this absorption for its essential food supply.

These receptors have the ability to absorb substances which are toxic first to the cell, later to the body as a whole. The absorption of these toxic substances may be an effort on the part of the individual cell to protect the remaining cells from harm thus acting as a *scout or sentry*. The very large majority of the cells which take part in this defensive action are discharged from myelogenous or lymphogenous tissues and these cells are especially active when the invasion of bacteria is rapid or a poison is being rapidly absorbed. The introduction of a toxin stimulates an excessive production of receptors, which are finally thrown out into circulation and constitute the antitoxins.

Bayliss says: "Fatigue can be produced with ultra-violet light in Cyclops by very short durations of radiation or by cocaine, but not if the anesthesia is of central origin; by either, for example. In this latter case the peripheral organs are left intact. These facts show that the reaction studied is really due to photochemical changes at the periphery.

"Since the absorbing power of protoplasm is very great, especially for the shorter wave lengths of ultra-violet, the effect can penetrate for only a short distance. In such small organisms as bacteria, however, it may affect the whole organism, so that the action, which is a lethal one in such cases, obeys the laws of photochemical reactions. In larger organisms we have to take account of diffusion of the products of photochemical change, and their

action at places remote from that where they are formed. The lows are, therefore, more complex, and the effects last longer than the actual exposure.

"While bacteria were killed in from fifteen to sixty-five seconds, Mme. V. Henri and Victor Henri (1912, pages 29-31) find that there is no particular wave length which is specially lethal, but that the effect increases more and more the shorter the wave length, as far as tested, that is, up to $214\ \mu\mu$. Protozoa are killed in about the same length of time as bacteria, according to Hertel. The body swells, water-drops appear upon the surface, and finally disintegration occurs. . . . Diphtheria toxin was destroyed in five minutes, but antitoxin was not destroyed in thirty minutes. Various enzymes were also rendered inactive.

"Hertel regards the effect as due to reduction processes, for three reasons:

1. The effect is less in the green hydra than in the colorless one, presumably due to the oxygen afforded by chlorophyll.
2. Oxyhemoglobin is reduced.
3. If alizarin blue is injected into the veins of a rabbit, the brain is blue, but, if acted on by ultra-violet light, the dye is reduced to its colorless derivative.

"An interesting point is that, if rays of equal energy (as measured by the thermopile) are taken—one of $440\ \mu\mu$, the other of $280\ \mu\mu$ —Hertel found that rotifers are killed by the short waves in fifteen seconds, by the long waves long after four or five hours. This fact shows strikingly that *it is not a question merely of energy but of actual wave length, no doubt because the short waves are absorbed by the protoplasm.*

"We have seen how large a number of photochemical reactions are brought about by ultra-violet light, so that we may expect to find it active also on protoplasmic systems. But the nature of these reactions in the latter case is still unexplained. However, protoplasm under the ordinary microscope with ordinary illumination is structureless, but under the ultra-microscope presents the characteristics of a colloidal system, and by this method it has been demonstrated that protoplasm forms organs for particular purposes which appear and disappear according to need. Protoplasm itself is a complex of substances of various chemical natures and in various states of aggregation, associated together by forces of surface tension, electrical charge, etc. The liquid state enables an elaborate play of forces to take place, and chemical reactions can evidently proceed simultaneously in different parts of a cell. Apparently the shorter the wave lengths the greater their absorption by protoplasm up to the point of its destruction.

"Although ultra-violet light has so much more action on protoplasm than visible light, it has been found by several observers that light which has no action by itself on infusoria, bacteria, or blood produces the effect of ultra-violet light when certain dyestuffs are present (eosin, for example). The dye is absorbed on the surface of the organism and the effect is probably produced by the activation of oxygen or perhaps by a product of the oxidation of the dye, since it requires the presence of oxygen for the phenomenon to occur. Radiant light energy is directly converted into chemical energy by photochemical reactions which do not obey the law of mass action."

One of the great difficulties in the therapeutic application of ultra-violet rays to stop the growth of malignant cells is the very rapid absorption by the superficial cells, so that the active rays penetrate only a short distance. When those which do penetrate the deeper structures are absorbed by the hemoglobin, which is so active and absorbent of ultra-violet rays, the entire body is affected.

Finsen in 1901 used the method of compressing the blood out of the area of tissue to be acted upon by the ultra-violet light. He had splendid success in the treatment of superficial skin growths, such as lupus, by ultra-violet light frequencies. E. K. Martin (1912) found that the cornea absorbs all rays shorter than 2950 Angström units thus protecting the lens and retina from the action of the short frequencies. It was thus found that while the mercury arc caused conjunctivitis, no change in the lens could be detected.

Bayliss further states, "Chlorophyll contains magnesium and nitrogen but no iron or phosphorus, differing herein from hemoglobin, and is the ester of a complex acid consisting of pyrrol derivatives linked to magnesia. Chlorophyll loses its magnesia more easily than hemoglobin does its iron.

"The effects produced by radium on living tissues are very similar to those of intense ultra-violet light, but much more powerful. The explanation of their action is not yet clear. The advantage of applying radium to the spot required is obvious. For further information on this extremely interesting phenomena of radioactivity the reader is referred to the book by Rutherford (1913), by Soddy (1914), and regarding the action on living tissues, to that by Finzi (1914).

"The phenomena of resonance play a large part in the mechanism of photochemical reactions. If the vibration period of a molecule coincides with that of any of the light waves falling upon it, the molecule will be set into resonant agitation by means of the light energy absorbed. This vibration usually leads to chemical change.

"Photo-chemical reactions do not obey the law of mass action, because their rate is controlled by the amount of light energy absorbed per unit of time.

"The direct action of ultra-violet light on micro-organisms is a lethal or destructive one. The shorter the wave length, the more powerful the effect with equal energy of the radiation, probably owing to the greater absorption of the short waves by protoplasm. Similar action can be produced by visible light in the presence of a dye which can absorb this light (a photo-dynamic sensitization)."

It is well known that these rays are readily absorbed, and the blood passing through the capillaries doubtless absorbs most of the near ultra-violet frequencies while the skin and its products absorb the middle ultra-violet frequencies. Bacteria are destroyed by the wave lengths of the middle ultra-violet frequencies both directly and indirectly. Just how the latter is brought about we cannot say, but that deep-seated infections which cannot be reached directly by these rays are benefited by them, possibly through the development of other as yet unknown rays, or chemical reactions, is a fact which cannot be disputed; but the exact action of the ultra-violet frequencies upon living human tissues has not been demonstrated.

The probability is that these rays act upon the lymph, endothelial cells, erythrocytes, leukocytes, hemoglobin, and blood platelets which as well as other blood-coloring matters are very active absorbents of these rays. They also act upon glandular tissue and the secretion products of the skin increasing their phagocytic power in much the same manner as sunlight improves the vitality and the immunizing power of the body. They aid the development of the antibodies and are, therefore, antigenic. In this way the bacteria which are deeply situated in the tissues of the body are destroyed by these rays. Superficially bacteria are destroyed by the reaction which is set up in the protoplasm of the bacterial cell causing it first to increase its watery content later to become mummified.

Remember that antigens stimulate the production of antibodies. Antigens may be infectious or harmless bacteria, animal cells, toxic substances, or innocuous proteins. Actinic rays may break down proteid matter, producing toxins or enzymes of unknown chemical composition. Antibodies have never been isolated and their chemical nature is unknown, but they accompany or are a part of the serum proteins. Their characteristics are the same. They are unstable compounds easily destroyed by heat or chemicals and probably by chemical light frequencies. Proteins are complex, nitrogenous bodies which play an important part in the chemical reactions and the metabolism of the cell, and according to Houghton and Davis interfere with the action of actinic rays.

All antigens are colloidal in form although their exact chemistry is at present unknown. It must be remembered, however, that all colloids are not antigens.

Prophylaxis is that state of the body where the tissues contain or can immediately develop substances which are called antibodies or body defenses. The individual whose tissues so react is protected against infections and is immune. Individuals who have developed a sufficient number of antibodies to repel an invasion of a particular bacteria are in certain instances as in small pox, scarlet fever, pertussis, anterior poliomyelitis acuta, etc., immune for a period of time extending from months to years. Temporary passive immunity may be given an individual by the artificial introduction of specific antibodies.

In addition to this antibody defense of the body cells, we have the absorptive defense which certain cells possess. These cells which have the power of absorbing various bacteria and chemicals are known as phagocytes. On the other hand it must be remembered that certain bacteria, i.e., *bacillus anthracis*, *bacillus tetani*, and *bacillus aërogenes capsulatus* have the power of producing spores when in danger of extermination. These spores are resting forms which in unfavorable media, simply hibernate until such time as environmental conditions are favorable to their propagation. They are covered with a protective layer which makes it extremely difficult to destroy them by heat or chemicals except by the intermittent method of destruction which does not kill the spores but does allow them to develop between efforts at sterilization. The developed bacteria are then destroyed by the usual methods of hospital sterilization.

Jordan states, "The study of bacteria is important on account of the changes which they bring about in the chemical nature of their environment."

Kendall says, "In the study of the various bacteria, their physical and chemical characteristics demand first attention this to be followed closely by their action on other cells and their ability to change their chemical environment to one better suited to their growth and production. Among the chemical substances liberated by bacteria will be found skatola, indol, lactic, acetic, and succinic acids, some of which are injurious to the system, others are not. Bacteria also have the power to change their own body chemistry to meet a change of environment unsuited to their usual living conditions."

Harris and Hoyt, University of California, state, "Ultra-violet light is generally highly toxic, even for colorless organisms, and, since this toxicity presumably depends upon and is attributed to photochemical reactions, the question presents itself: To which constituent of the protoplasm are we to attribute the selective absorption of these rays, which is the necessary precedent of their photochemical activity? We may infer that solutions of gelatin, peptone, aminobenzoic acid, cystin, tyrosin, and leucin detoxicate

ultra-violet rays which pass through them. Many others do not. We may infer that ultra-violet light induces chemical changes in a leucin solution resulting in the production of substances having an enhanced power of absorbing ultra-violet rays. Our results are, therefore, decidedly in harmony with the view that the susceptibility of protoplasm to ultra-violet light is conditioned by the aromatic amino-acid radicals of the proteins."

In conjunction with the action of the actinic rays upon the blood stream must be studied their action upon the cuticle, which is exfoliated, thus increasing elimination of toxins from the body, both temporarily and permanently. The exfoliation of the cuticle improves the local nutrition and frees the obstructed glands. This is clinically certain, even though we cannot explain in a scientific manner just how these rays penetrate the surface of the body to gain entrance to the blood stream, but that they do we do not doubt. If you will use these rays in treating your cases suffering from acute infections or with chronic constitutional disorders, and will use them conscientiously and persistently giving sufficient time for the rays to act and of sufficient quantity and frequency to get a continued effect, we are morally certain that you will agree with us that they are the best single method of treatment you possess. It is taken for granted that you will not try to supplant all other forms of treatment with actinic rays.

As these rays are chemical, they produce chemical changes within the blood stream and the sterol and other substances within the skin and these changes increase their physiological activity. The only time we have known of their producing any pathological activity was when a patient (taking a treatment in her own home) went to sleep under the air-cooled lamp and remained there for one hour. After this experience she was dull, stupid, and inactive and suffered from amnesia or loss of will power for several days. It must be remembered, however, that these rays activate the system in much the same way as do the bacterines and vaccines, producing chills followed by a rise of temperature, anorexia, nausea, headache, prostration, and at times, congestion of the kidneys. However, these are but a too sudden awakening of the resisting powers of the body, and the too rapid effort at elimination of toxins.

The main advantage of a quartz-mercury lamp over sunlight is that we have control of a constant source of supply of known quantity for use upon all occasions and under the best of conditions. It also has the advantage of producing shorter wave lengths.

Remember once and for all time that actinic rays have nothing to do with what are commonly called violet rays which are nothing but high-frequency currents of exceedingly rapid oscillations which are produced in glass vacuum tubes. The color depends upon the degree of vacuity. The low vacuums giving a red and the high vacuums a yellow color.

Remember also that actinic rays will not pass through glass in any appreciable quantity, also that these rays will penetrate water and that the water so penetrated will be sterile. The General Electric Company now put out a lamp which they guarantee will kill all bacteria in a twelve-inch column of water as it passes the lamp. The cost of this sterilization is about sixty cents per million gallons of water.

Cell structures may be transparent to visible light yet opaque to actinic rays and this explains the statement above that opacity means absorption and absorption means chemical change and this change may be beneficial or destructive according to the kind of tissue acted upon, the length of exposure, and the frequency of the vibratory wave. If too short for the absorption to take place, the action will be slight, while if all the waves are absorbed and the quantity is sufficient, destruction is inevitable.

In studying the action of light rays upon cell life, remember that the cell, though microscopic or ultra-microscopic, is composed of different structures, all of which are acted upon differently by the same light frequency. The presence of dye stuffs in the blood stream causes the absorption of certain light frequencies, hence changes the action of any light from a given source. The distance of the source of light from the object exposed changes the effective frequency and of course, alters materially the therapeutic field.

After an intravenous injection of 0.2 gm. of hematoporphyrin Betz found himself extremely sensitive to sunlight (7700 to 3900 Angström units). This sensitiveness persisted for several months, disappearing gradually during the following winter. In his case an exposure of one minute gave him a reaction lasting several hours. The reaction was expressed chiefly by itching and edema.

Photography by actinic rays is the acme of this science today and phototherapy of intravital cell structure by radiation with ultra-light frequencies may by the same process be its acme in the near future. Already many of the protoplasmic structures are thus made visible.

Intravital staining was first brought to the attention of the scientific world by Ehrlich in 1886, when he proved that methylene-blue stains living nerve tissues. Since that time he has used various dyes and holds that certain dyes have special affinities for specific portions of protoplasmic molecules; however, these special affinities are modified or accelerated in various ways. Ionization, actinic rays, etc., change the character of certain dyes and may cause an increase in the amount absorbed by the protoplasmic molecules. In this connection it must be remembered that short wave lengths and electrons are nearing the limits of present-day knowledge.

Do not forget that living nuclei are apparently unstainable. It has been proved that protoplasm contains all the chemical elements found in the organic compounds together with various salts

of these elements. Whether substances can be divided into the organic and inorganic compounds is today a debatable question. Some of the foremost scientists think this division impossible and that everything is simple chemistry indivisible.

Nitrogenous bodies known as proteins are highly complex chemical reactions taking place during metabolism which require certain lipoids, carbohydrates, and water for their completion. Living protoplasm presents the characteristics of liquids, but when death occurs it becomes gelatinoid and its parts fixed. Apparent death of a cell may take place and yet resuscitation occur by electrical or light (vibratory) stimulation.

Cell chemistry as we know it is a substance in equilibrium, and living cells as we know them are in a state of constant change, which is dependent upon the food supply and the ability of the cell to assimilate the food supplied.

That actinic rays will heal X-ray burns is without question. That they will heal every case, without question as to its age or severity, is open to question, but that they will benefit every case is without doubt in the writer's mind, for we have taken burns which were eight years old and obtained great benefit in a single treatment with a water-cooled mercury-quartz lamp. Recently we had a case of eight weeks' standing which was gradually growing worse, the area involved being about ten by fifteen cm. One-half of the area healed in twenty-four hours after a one-minute treatment with a modern air-cooled mercury quartz-vapor lamp, and the remaining portion closed in forty-eight hours after a second treatment of two minutes. We have also taken cases twenty-two years old and healed them in eight weeks.

We have made the statement repeatedly for years that a case which had received a full dose or course of doses of X-ray could be given a half-dozen daily treatments of actinic rays and the X-ray treatments repeated without danger of severe surface burns.

Of this we are now certain: Actinic-ray treatments following X-ray or radium treatments render the latter innocuous on the surface although they do not control the gamma-ray action on the deeper tissues. The actinic-ray treatments should be of sufficient length to produce a distinct hyperemia and blistering will do more good than harm, although it is usually unnecessary. About one minute at forty cm. with an air-cooled quartz mercury-vapor lamp will do for the first treatment, increasing one minute daily up to ten minutes. With a modern water-cooled lamp one-fourth minute at five cm. would be about right.

On page 50 we give our reasons for preceding each actinic-ray treatment with a visible-light treatment. These reasons are well amplified by the experiences of ourselves and others and we feel more than ever that a phototherapy treatment is not giving the best results if carried out in any other way.

Professor H. Steenbock (University of Wisconsin) in a personal communication of recent date makes the following statement: "In recent years we have gained a far greater insight into the biological action of light by the discovery that certain compounds can be so changed by its action that they become therapeutically active. One of these substances is a beautiful white crystalline compound known as cholesterol. As far as we know it is found in every animal cell, but it occurs in special abundance in nerve tissue and in the skin. It has often attracted the attention of the pathologists because under certain conditions not well understood, it crystallizes out from bile and forms the concretions which are often spoken of as gall stones. Although the physiologist has not neglected giving consideration to the possible function of cholesterol, no experiments have ever been successful in establishing the role played by cholesterol in the maintenance of the normal animal organism.

"Now we know that when cholesterol is exposed to the radiation of a quartz mercury vapor-lamp or any other radiations containing the ultra-violet ranging in wave length from 250 to 302 millimicrons, it becomes antirachitically active. The time of exposure necessary to accomplish this varies, of course, with the intensity of the illumination and the distance. As ordinarily carried out in our laboratory we have found that an exposure of 30 minutes at a distance of 2 feet with a quartz mercury vapor-burner carrying a current of 5 amperes and 50 volts is sufficient. Under these conditions the cholesterol becomes so active that 1 milligram will produce a pronounced calcium deposit in a rachitic rat weighing 100 grams in the short interval of 10 days. Of unexposed cholesterol a dose many thousand times as large has been found to have absolutely no effect whatsoever.

"The richness of the skin in cholesterol immediately suggests how light can exert an antirachitic action upon the body. The failure of ultra-violet light to possess great penetrating power has always constituted a conundrum when it came to explain how light can cure bone diseases. In the light of what we now know it seems very probably that this effect is brought about through the mediation of compounds such as cholesterol which are reabsorbed from the skin into the circulation and carried to all tissues of the body.

"Unfortunately as far as attaining complete understanding of the mechanism of the reaction is concerned we know practically nothing about the intimate structure of cholesterol to begin with, and we have as yet no clue as to how activated cholesterol can so affect the metabolism of the bone cell that it functions in depositing inorganic salts. These are things which demand urgent attention, but for the present we can consider it a distinct attainment in having demonstrated that therapeutic properties can be imparted to organic compounds by their exposure to light. This places the

entire matter of light therapy in a position where those who have criticized its use will be forced to admit the existence of a scientific foundation for its application in certain maladies."

Professor Steenbock does not think that cod-liver oil can be further activated by the use of ultra-violet light.

In the A. M. A. Jr., April 11, 1925, Vol. 84, No. 15 he summarizes his article on "Irradiated Foods and Irradiated Organic Compounds" as follows: "By exposing such food materials as wheat, rolled oats, corn, hominy, cream of wheat, shredded wheat biscuits, corn flakes, patent wheat flour, cornstarch, meat, milk and egg yolk to ultra-violet light, they can be endowed with rickets preventing properties. That such a wide variety of foods can be thus affected appears to be due to the fact that practically all naturally occurring foods contain lipoidal constituents of the nature of sterols which can carry this activation. Cholesterol, for example, as obtained from brain is entirely inactive, but after exposure to ultra-violet light becomes rickets preventing.

"As fats are good solvents for these lipoids, practically all fresh fats, such as butter fat, olive oil, lard, corn oil, cocoanut oil and cottonseed oil, can be activated, often to a degree to make them compare favorably with cod liver oil. As antirachitic action consists in the induction of calcium assimilation and its conservation for the animal, this is a matter which concerns not only the young but also the adult.

"It is suggested that these findings may have their significance not only in nutrition, but also in the therapy of those diseases known to respond to irradiation with ultra-violet light."

A. F. Hess, M. D., of the College of Physicians and Surgeons, New York City, has accomplished much in a scientific way in the study of the action of ultra-violet in both rickets and tetany and finds that there is a decided increase in the metabolism of calcium and inorganic phosphorus.

Johns Hopkins Hospital, Baltimore, has installed a quartz window in the pediatric clinic for use in the treatment of rickets and tuberculosis.

Irradiated foods will soon be found on the market at high prices and with little likelihood that they are either properly radiated or that they have retained the activation given them. Hence it is safer to buy foods known to contain the needed vitamin than to pay high prices for an uncertainty.

CHAPTER X

Therapeutics of Actinic Rays.

The therapeutic uses of actinic rays from the quartz-mercury lamps are as follows: Constructively, they are antigenic, they increase immunity, they are bactericidal, they increase oxidation, they increase the erythrocytes and normalize the leukocyte count, they allay inflammatory conditions by destroying bacteria (spirochetes seemingly are an exception to this rule), they are antipruritic and analgesic, and in neurasthenic conditions, they both vitalize and soothe.

Destructively, they are used to destroy infectious bacteria (except spirochetes), some foreign growths, and the epidermis.

These rays positively will not destroy the normal tissue within a reasonable length of time (say twenty minutes), although they do produce a severe benign inflammatory reaction after five or more minutes but this reaction is, many times, exactly what we wish to produce and even in the most severe cases, it usually subsides in three or four days. Prolonged (17 to 48 hours) irradiation destroys activated cholesterol and phytosterol according to the experiments of both Steenbock and Hess working independently.

A very few exceptions to the above rule have been found in which there is an idiosyncrasy. In one case after a ten second exposure, it was nearly a month before the blisters healed. Dr. W. W. Duke, Kansas City, Missouri, December 1924 (*Light Sensitiveness, Radiology*, page 297) at the convention of the Radiological Society of North America exhibited three cases that produced immediate hyperemia after an exposure of twenty seconds. Duke reported another case (June 23, 1923, *A.M.A. Journal*) female age 43, who became so extremely sensitive to the violet region of the spectrum (4300 to 3900 Angström units) that an exposure of one minute to sunlight caused her to become ill. The principal symptoms were itching, redness, and edema, which were localized to the exposed areas, followed in a few hours by slight chills, marked weakness, and malaise.

This case was probably a true allergy or a photodynamic anaphylaxis produced by the long actinic rays in the violet region. Duke states, "Exposure of the skin to heat, Roentgen ray, or ultra-violet ray as produced by a quartz mercury-vapor lamp, and sunlight filtered through Wood's nickel oxid glass, produced no visible effect on the skin after exposures of from three to five minutes." We have since had a case of sciatica that took three weeks to heal after an exposure of fifteen seconds but these five cases are all that

have come to my direct attention. Doubtless there are a few others but these cases are extremely rare.

The early use of these rays from an artificial source (the Finsen lamp) was limited to the surface of the body, but for some twelve years past we have known that all tissues are affected by them, either directly or indirectly, and therefore, constitutional disorders are benefited by their use.

In giving the general visible-light and actinic-ray treatments, we begin by giving a minimum of ten minutes with the visible light, front and back from the neck to the thighs. This is immediately followed by the general actinic-ray treatment from the air-cooled lamp exposing the same area as that exposed to the visible light but in the reverse order, back first then front. The radiation energy from these lamps is many times (probably more than thirty) as potent as the ultra-violet energy from the sun.

Actinic Rays Air-Cooled Lamp.

The first actinic-ray treatment is from one-half to one minute in duration, the distance is about twenty-four inches. This first treatment is very short to learn the resistance of the individual patient to the actinic rays. Subsequent treatments are increased one-half to one minute daily until periods of ten minutes are reached, then the treatments are continued at this period of time. It is very seldom, indeed, that we go beyond the ten-minute period. Beyond this we encounter the law of diminishing returns and the results do not compensate for the extra time. The above time applies to each surface of the body treated, thus the full general treatment, after the tenth day, requires forty minutes. The visible light is kept at distance which is comfortable to the patient.

In cases of low vitality as in infants, it is at times advisable to raise the lamp (air-cooled) to 30 or 40 inches above the patient and increase the length of the treatment to fifteen or twenty minutes, starting the case as usual with one minute for the first treatment and increasing gradually to tolerance or until periods of fifteen to twenty minutes are reached. Daily treatments in these cases are necessary and the actinic-ray treatments should be preceded by a visible-light treatment of prolonged duration, the time limit being the tolerance of the case. The distance of this lamp from the patient must be increased usually to four or more feet.

The general actinic-ray treatment with the air-cooled lamp is started at a distance of twenty-four inches (skin-target) and gradually decreased to about fourteen inches (skin-target distance). This applies to the air-cooled lamp only and for general treatments. If the air-cooled lamp is used for local treatments, the distance should be about 8 inches (skin-target) and the time would be about twice that given for the water-cooled lamp.

For local treatments and for small areas, we use a water-cooled lamp, usually in contact or nearly so. The time of the

treatment with the water-cooled lamp varies from a flash for the eyes to twenty minutes for a few cases of the naevi with an average of about two minutes for the surface of the body, while for the mucous membranes a treatment of one-half to two minutes is sufficient.

In giving a general body exposure, the eyes are the only portions that are fully protected, and these only to avoid a benign conjunctivitis, which, while exceedingly painful, is not destructive. For the protection of the eyes during facial treatments, the lids are covered with small pledgets of absorbent cotton, which are held in place by tying a thread over them and around the head. It has been found best in a few instances to ray every possible inch of the body but this is exceedingly rare.

The treatment of conjunctivitis with actinic rays is perfectly feasible, as are cases of palpebral infections. W. E. Burge (Archives of Ophthalmology, September, 1915) found by experimentation that the lens of the eye was still transparent after one hundred consecutive hours of exposure to actinic rays from a quartz lamp; thus proving almost conclusively that these rays will not destroy the transparency of the lens within any reasonable length of time.

Exception: Analyses show a decided increase in the amount of salts contained in cataractous lenses, and these have been proved to be calcium chlorid, magnesium chlorid, and sodium silicate, and as cataracts are found in diabetics, dextrose probably plays a part in their formation. Using these known facts, Burge continued his experiments using these substances in solution and found that the lens protein modified by them could be coagulated by actinic radiation and opacity of the lens produced. It appears from the experiments that these same substances decreased the fluorescence of the lens, and Burge suggests the thought, that there may be some relation between the fluorescent property of the lens and its ability to resist the actinic radiations.

Experiments were then made with actinic rays on non-fluorescing and fluorescing bacteria and it was found that, of seven different kinds of the first variety, none were alive after an exposure of two hundred seconds, while none of the cultures of the latter form of bacteria were completely destroyed after a similar length of time. Burge advances the provisional hypothesis that the great resistance exhibited by the lens and by fluorescing bacteria to the action of the actinic rays is due to the power of fluorescence, and he assumes that the lens and fluorescing bacteria convert the absorbed short waves into longer wave lengths thus diminishing more or less the energy which otherwise would have been spent in coagulating their protein.

In treating chronic cases, immediate results must not be expected, but rather a gradual improvement from week to week,

while in acute cases improvement within a few hours is often seen. We sometimes get results in minutes.

Experience has taught us that much greater benefit can be obtained if the capillaries are first dilated with the rays from a 1000-watt bulb giving visible light, thus bringing the blood to the surface where it can be acted upon by the actinic rays. Lymph and blood stasis are relieved by the same method and at the same time.

Such cases as X-ray burns, telangiectasis, osteomyelitis, splenomedullary leukemia, and Hodgkin's disease are being treated with these rays, as well as chlorosis, secondary anemia, and nephritis, and with good results. We quote the foregoing wide range of diseases to show the possibility of the use of these rays.

We have used these rays from the water-cooled lamp, with the lamp in contact with the skin, for twenty consecutive minutes without any destruction of normal tissue below the epidermis. This was in a case of nevus.

In gynecology splendid success is being obtained and such cases as Neisserian infections, pelvic inflammations, endometritis, cervical erosions, vaginitis, endocervicitis, pruritis vulvae, dysmenorrhea, and metrorrhagia are being treated successfully. These treatments are usually given with the water-cooled lamp, although they may be given with the air-cooled. The first treatment given is of one minute's duration, the subsequent ones running up to five. The local treatments are given through a bivalve vaginal speculum using a proctoscope to avoid burning the vulva.

Remember that these rays are used as an auxiliary to recognized methods of treatment.

In surgery, the actinic rays are of immense value as a follow-up treatment, using them for both local and general effect. General radiation is used to improve the vitality of the individual and to restore the vegetative functions to normal. Locally they are used to destroy infections, to heal fistulous tracts, and to stimulate granulations.

The following case illustrates the increase of granulation tissue occurring in an open sore when the rays are properly used: A fistula due to tubercular adenitis of six months' standing *was closed inside of three days following a single two-minute treatment with the water-cooled lamp.* The case received nine treatments in all. In another case of numerous sinuses following operation for tubercular adenitis, all the sinuses were closed in six days after five daily treatments. The edema of lymphangitis has been known to disappear within twenty-four hours after three treatments a few hours apart. The general improvement of the patient is marked, many times after the first and almost invariably after five or more treatments. Capillary oozing from fresh wounds is readily controlled by the action of actinic rays, and not only are the superficial blood vessels occluded but the lymph vessels as well.

What applies to one applies to both. This action, no doubt, explains the rapid relief of symptoms in cases of lymphatic infections.

Rollier is authority for the statement that the actinic rays activate oxygen, and it is well known to all users of the quartz lamp that ozone is produced in quantity upon lighting the lamp and to a less extent after it is properly heated. The exact amount of benefit the patient under treatment receives from the ozone so generated is not known, but undoubtedly it has a certain amount of health-giving properties and apparently no detrimental effects even though we cannot measure it exactly. It is a well-known scientific fact that the skin absorbs oxygen in large quantities and this absorption is more rapid when taking these treatments because of atmospheric contact with the nude body. It is also well known that when the skin is covered by an impermeable dressing, thus excluding oxygen, the individual soon dies; therefore it is easily understood that any additional oxygen, whether externally or internally, which may be given to a person suffering from a deficiency of oxygen will aid materially in restoring that individual to health.

Metabolic changes, both local and general, are rapidly increased following treatments with actinic rays. Many times a single treatment of but a few minutes' duration will produce results which are a marvel to the individual receiving the treatment and to the person administering it. As an instance of the above-mentioned relief, we have seen the pain of a gastric ulcer which had been almost continuous for months completely relieved after a five-minute treatment. So complete was this relief that the patient, who had been unable to sleep for more than an hour at a time for months previous to the treatment, was able to sleep fourteen consecutive hours following this single treatment. No drugs were used. Berthelot claims to have reproduced the digestive processes by the frequencies from the quartz-mercury arc without the aid of ferments.

Metabolic changes in localized surface areas are also very rapid, and we say this advisedly, for we have seen the pain of a streptococcic infection of some hours' duration, which was extending rapidly, completely relieved after a two-minute treatment. It is not possible to ascribe this relief to increased phagocytic action alone in this length of time; hence it must be due to destruction of the bacteria within the area, which would stop the production of the toxins and the rapid absorption of the chemical or toxic irritants which caused the pain.

The normal elimination of toxins is very rapid once their production is stopped, but the rapidity of elimination is increased by the action of the actinic rays in all cases where the functions of the eliminative organs are not too badly interfered with or the organ itself destroyed. This action may take place at some distance from the area treated, and it can only be ascribed to the changed condi-

tion of the blood stream by the absorption of the actinic rays or the development of other unknown rays or reactions produced by the action of these chemical rays upon the constituents of the blood stream or the body tissues, and in particular upon the sterol products of the skin (Steenbock).

As we have previously stated, actinic rays are not destructive of normal tissues or functions, but are truly anabolic in their action, raising the resistance of the tissues, both local and general. In other words, they aid nature in her fight against disease. One can use these rays to produce the simplest hyperemia or to produce an active hyperemia extending into the tissues for an inch or more; and it is intensely interesting to watch the benign inflammatory reaction so produced destroy the pathological inflammation due to an infection. Again your attention is called to the fact that the reaction produced by these rays is truly benign and is never destructive of normal tissue below the epidermis.

Just a word of caution should be added to the above statement, to the effect that granulating tissue may be destroyed by these rays before it becomes fully organized; hence a shorter treatment and a greater distance from the lamp are necessary. As a general statement, not more than one-tenth of a full treatment should be used under the above conditions usually starting with a few flashes.

The effect on metabolism is well shown in the action of these rays upon patients suffering from nephritis. In many of these cases, the inflammation of the kidney subsides and casts and albumin disappear from the urine, and with this improvement comes a corresponding lowering of the blood pressure. In these cases, we do not doubt but much of the improvement in the individual's general condition comes from the improvement in the tissues of the body as a whole, for the elimination is decidedly increased (urea and creatinin elimination is especially increased) and all normal processes activated. The results of the general raying of the entire nude body are an increase in the percentage of hemoglobin and the number of erythrocytes and blood platelets toward normal, while if the white corpuscles of the blood are increased in number, this treatment will reduce them. If the leucocytes are decreased it will increase them, in short it normalizes the white count.

The many uses to which the actinic rays may be put in the treatment of diseased conditions are not known. With many scientists now working in this field, each year sees the field extended and each new success brings with it new light. There are many surprises in store for those who are using the rays constantly, and we can say this to those who are just beginning their use: *You will, on more than one occasion, doubt your own diagnosis or else you will change your prognosis.*

After purchasing a lamp, use it on yourself before trying it on a patient. The results will be of advantage to you and to your

future cases. It will give you some real knowledge of what these rays will accomplish locally and teach you that you are dealing with a very potent agent. While the blisters which they produce are very uncomfortable, they are many times very necessary, and after a patient has experienced decided relief from them, he will frequently ask to be blistered. To blister a patient with the first treatment will, many times, frighten him into discontinuing the treatment, especially if he has not been informed in advance of this possible reaction. When using the water-cooled lamp, this caution is needed more than with the air-cooled lamp. When the quartz lenses are used on the water-cooled lamp for compression, the action is still more intense. Ten seconds with the water-cooled lamp in contact will, in many cases, produce a sunburn that will be apparent for a week; notwithstanding this, we frequently treat the same area daily, and, as has been noted elsewhere, we have extended the period of a single treatment to twenty minutes.

The use of the water-cooled lamp is not practical for general treatments. The air-cooled lamp can be used for local treatments, many times with good results, but on the other hand the water-cooled lamp should not be used for general treatments as it is impossible to give an even raying of the body and it is also impossible to gauge the time of each area.

The water-cooled lamp should be used for local treatments which may be on the surface or in the various cavities. When used on the surface, no special applicators are needed except to reduce the size of the face of the lamp to that needed for the treatment being given, then it is best to use the tubular reducing steel applicators. The other exception is where it is desired to use compression, as in treating naevi or hemorrhoids, then one should use a solid quartz applicator of the size and shape required for the individual case. If the exact size or shape is not at hand, the surrounding surface can be protected by cutting a hole in ZO adhesive of sufficient size to expose the desired area for treatment then use such applicators as are at hand, or if practicable use the face of the lamp in direct contact with the tissue. Remember that an area larger than the apparent diseased area should be treated. For naevi this should be one-half inch while for tinea or bacterial diseases, it is best to ray at least an inch or two beyond the visible disease. At times very wide areas should be rayed.

When raying cavities be sure to protect the margins unless they too are diseased. For the mouth and pharynx we use a tubular applicator; for the ear or nose a solid quartz rod; for the vagina and cervix a bivalve speculum, through which we use a proctoscope to avoid burning the vulva, giving the first half of the treatment with the bivalve blades antero-posteriorly, the second half with the blades laterally (rotate the speculum one-quarter), thus all surfaces are rayed and if desired at the end of this treatment the

urethra and Skene's glands can also be rayed. For the rectum we use a proctoscope or if one desires to ray farther up the bowel, a sigmoidoscope is used. The prostate gland and seminal vesicles are rayed through a proctoscope. The urinary bladder is rayed through the vagina in the female and through the rectum in the male.

The time required to ray a cavity is from a quarter of a minute to six minutes; average about two minutes. For the gums we keep the lamp moving slowly; we ray the tonsils and pharynx from one-half to two minutes each, average one minute. The time for the vagina and cervix is one-half to two minutes; for the rectum one to two minutes each area, while for the surface of the body the time will be from a few flashes for the eyes to twenty minutes for naevi, average time for naevi four minutes each area, using compression where it is possible. The time for external thrombotic hemorrhoids is one-half to two minutes each area, average one minute. For raying fistula or pruritis a period of one to three minutes is necessary, average two minutes. It is not necessary to enter the fistula with a quartz applicator. For more detailed description of these treatments see under various headings.

Deep Penetration.

Recognizing the fact that the blood stream absorbs most of the actinic rays, it stands to reason that if deep penetration of tissues with large quantities of actinic rays from the quartz lamp is desired, all circulating blood must, as far as possible, be eliminated. This is done by what is known as the compression method, which is as follows: A quartz crystal lens is pressed firmly against the tissues thus interfering with the circulation of the blood for the time being; but, as this method prevents the blood absorption of the rays thus increasing local action, they must be used with caution and a shorter treatment given. It must be remembered that the extremely short actinic rays from the Schumann band are closely associated with the still shorter X-rays, which are exceedingly destructive of normal as well as of pathological tissue. In other words, in this region (the ultra-ultra-violet 1860 to 900 Angström units) of the spectrum, we are approaching the danger zone.

Quoting from a recent editorial of the Journal of the American Medical Association on *Light, Radiation and Protoplasm*, we give you the following: "The newer knowledge in the field of physics has brought a recognition of the fact that, in addition to the visible electromagnetic waves, the invisible infra-red and ultra-violet waves also have indisputable chemical and biologic effects. Dr. Bovie has recently reminded us anew that the substances of which living organisms are composed are capable of resonant vibrations over a considerable range of vibration frequency, including the

entire range of solar radiation. Protoplasm is capable of detection and being modified in some degree by the electromagnetic manifestations constituting the radiant energy received from the sun. * * * * The physiologic effects of light must be the result of photochemical reactions." One of the important discoveries made by Finsen was that it is the blood (and absorbable secretions in the skin, Steenbock) which absorbs most of the ultra-violet light. Ultra-violet rays coming from the sun penetrate blood-filled skin only a fraction of a millimeter, but if the skin is made ischemic (by pressure) bacteria can be killed by ultra-violet light which has passed through 4.25 millimeters of skin.

Regarding the use of the blue filters for screening out the shorter, more intensive rays and the use of compression for getting deep penetration, it has been found after years of constant use of the actinic rays that this is seldom necessary and that results were much better when all the rays coming from the lamp were used. Without the screens, shorter periods of time are necessary to obtain the same or better results. The usual period of treatment without the screens is from two to twenty minutes, with the screens from thirty to ninety minutes, and it has been found that it is next to impossible for a patient to sit still for these long periods of time. It has also been found that in the majority of cases short, frequent (daily) treatments were better than long treatments with prolonged periods of time intervening. In most cases, it is better to get a slight improvement from each treatment and to get the treatments close enough together to get a continued effect than to try to produce profound impressions with a single treatment. In short, evolution is always to be preferred to revolution.

The early use of these rays was limited to diseased conditions on the surface of the body, but, as has been stated, they are now being used effectively upon all tissues; but in treating the deeper structures, as in chronic constitutional disorders, one must not look for immediate results but rather for a gradual improvement noticeable from week to week. *It is understood that under all circumstances gross amounts of infective materials should, if possible, be removed by surgery before beginning the phototherapy treatments.*

Diseases affecting the epidermis are readily relieved and many of them cured in a short time. Eczemas are among the most favorable of conditions for treatment with actinic rays, but it must be remembered that these conditions are but local manifestations of etiological factors which are to be found in the deeper structures. Many, if not most, cases of eczema are due to disturbances of the vegetative functions. If the disordered functions are not corrected, only temporary results can be expected from phototherapeutic treatments. *Do not take it for granted that immediate relief of symptoms means a cure of underlying pathology.* What is true of the epidermis is also true of some diseases that affect the

derma and subdermal tissues; thus naevi and lupus (either erythematosus or vulgaris) are readily removed. The only destructive effect of the ultra-violet rays is upon the cuticle, which may be removed by them and with it any deviation from the normal occurring therein, and that without scarring.

The immediate action of actinic rays upon the blood vessels is upon the endothelium in which there is produced an active hyperemia and a proliferation of these cells (X-rays also produce a proliferation of these cells, but carry the proliferation to the point of occlusion of the blood vessel producing what is known as X-ray burn). Herein lies one differentiation of X-ray and ultra-violet ray burns: the former occludes all blood vessels, both surface and deep, causing destruction, while the latter destroys only the surface vessels, and then only the pathologic ones, wherein the endothelial cells are more readily proliferated.

After prolonged radiation of pathological tissue, a benign inflammatory reaction takes place which ends in the destruction of the blood vessel and the obliteration of its lumen, and this is exactly what we wish to produce when treating naevi. As these rays are absorbed by the blood stream, this inflammatory reaction is hastened by using compression with clear quartz crystal lenses. It is not necessary that all the pathology be destroyed at one sitting; in fact, it is better if but a portion is destroyed and this tissue exfoliated before another treatment is given. In this manner the destruction of tissue is under constant control and the end result should be normal tissue or nearly so. Herein is the advantage of ultra-violet rays over X-rays, radium, carbon-dioxide snow, cautery or surgery for some naevus cases, all of which destroy normal as well as abnormal tissue.

Some time ago we saw a case of lupus vulgaris of about the size of a quarter which was practically destroyed with one twelve-minute treatment with actinic rays (water-cooled lamp). A case of tinea barbae (see report, page 402) of four weeks' standing which covered the entire right side of the face and neck spreading beyond the median line both anteriorly and posteriorly, was practically sterilized in one treatment of nine minutes with the air-cooled lamp. The scab was removed the next day and never returned. No drugs of any kind were used.

Hypertrophied Tissues.

We are using the actinic rays for hypertrophied tonsils and turbinates. The congested turbinates of the hay fever case are readily contracted without the reactive dilatation of adrenalin, bringing relief in a half-hour's time.

We are also using these rays for prostatitis and vesiculitis, using our special applicator for these cases. Simple hypertrophy

of the prostate yields readily to the water-cooled lamp which gives very little relief to cases of fibroid or malignant prostates.

Tuberculosis in all forms seems amenable to these rays, even to the improvement of joint functions.

Try actinic rays on your neurasthenics if you want a real surprise.

Conclusions.

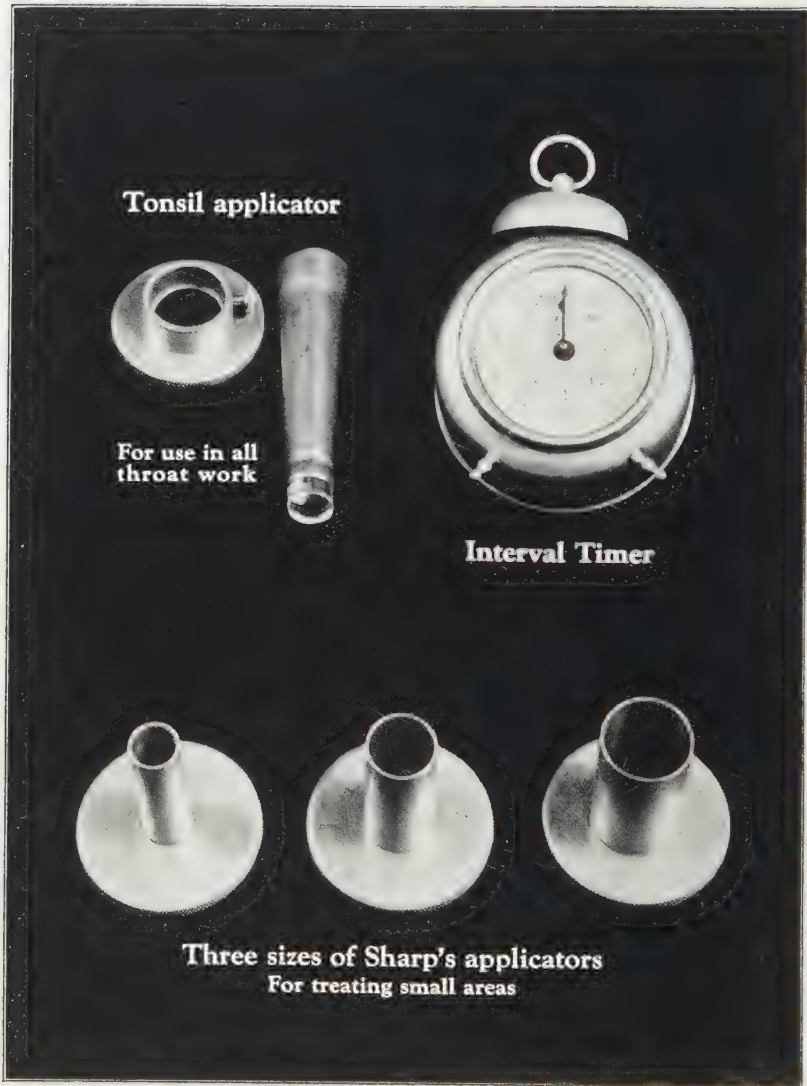
1. Infected wounds yield readily.
2. Actinic rays produce local effects when so desired.
3. Actinic rays produce systemic effects, even at a distance from the area rayed.
4. Actinic rays energize.
5. Actinic rays soothe.
6. Actinic rays produce a benign inflammation which is not destructive, but they destroy existing infection.
7. General actinic-ray treatments should be of one minute only for the first treatment, increasing one minute per day until ten-minute treatments are reached.
8. Actinic rays from the quartz mercury-vapor lamps will not destroy normal tissues within a half-hour's raying.
9. Local actinic-ray treatments may be given for ten minutes in contact if necessary. After many treatments are given, the time may be increased to twenty minutes if necessary.
10. Actinic-ray treatments should be given daily until improvement is noted and then less frequently.
11. A preceding visible-light treatment is essential to success.

Solid Quartz Applicators



Plate XIII

Applicators





Local application for small areas.



Nasal treatment.



Aural treatment.



Compression treatment



Pyorrhea inner surface of gums.

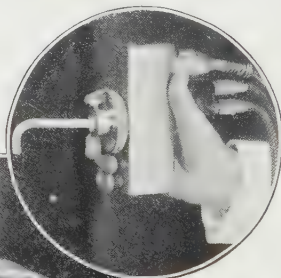


Outer surface of gums.

Showing method of using
Plank Curved Applicator (see
inset) for apical abscesses.



Showing method of treating
larynx with Plank Curved
Applicator (see inset).





Treatment of infected tonsils.



Bartholin abscess.

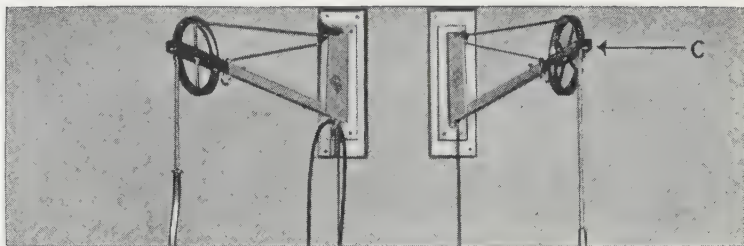


Pelvic treatment with air-cooled lamp.

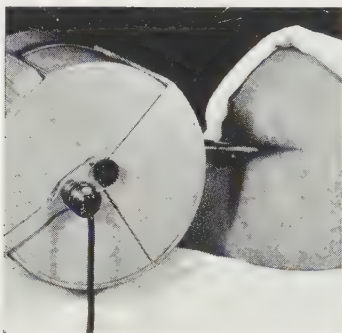


Pelvic treatment with water-cooled lamp.

Plate XVII



Showing best method of suspending visible and air-cooled lamp.



Prostatic treatment with air-cooled lamp.



Prostatic treatment with water-cooled lamp.



Treatment through sigmoidoscope.



Treatment of acute thrombotic hemorrhoids.

CHAPTER XI

Water-Cooled Lamp.

The water-cooled quartz mercury-vapor lamp differs from the air-cooled in construction and shape, space being provided around the burner for the circulation of water for cooling the burner so that close approximation of the lamp with the surface of the body may be had without danger of a heat burn.

The windows which allow the light from the quartz burner to pass through the water must be of quartz. This is the most transparent material we have today that is practical to use for ultra-violet rays. Fluorspar is more transparent for ultra-violet rays but up to the present time is not of practical use in clinical therapy although it is used for laboratory experiments when it is desired to obtain wave lengths shorter than 1860 Angström units.

The actinic rays produced by the water-cooled burner are exactly the same as those produced by the air-cooled burner. The rays delivered to the patient are of shorter wave length due to two causes: First, the proximity of the lamp. One can place the burner within three centimeters of the surface of the body thus excluding all but a small amount of air. The water, if clear, is nearly transparent to ultra-violet rays of longer wave length than 2000 Angström units and quartz is nearly opaque to wave lengths shorter than this although a few do get through down to 1860 Angström units. Ocean water has been found to be transparent to wave lengths from 4000 to 2000 Angström units to a depth of 3000 feet, while the blue and violet frequencies penetrate only 1500 feet. Vegetation is not found below a depth of 1800 feet in the ocean as radiations are not sufficient to maintain vegetable life below this point.

Regarding the penetration of rays from the quartz mercury-vapor lamp, Strutt (Proc. Roy. Soc. 1918, 260) was able to photograph the spectrum down to wave length 2536 Angström units at a distance of four miles using a two hour exposure.

It has been found best to use distilled water for cooling the water-cooled lamps as it is free from organic matter and mineral elements which coat the quartz windows rendering them more or less opaque according to the kind and thickness of the coating. In certain localities where the water is ordinarily clear and free from impurities, tap water may be used.

Second, it is thought by some that when the lamp is properly water cooled the vapor, which surrounds the mercury arc in the air-cooled burner, is condensed therefore there is not the amount of direct absorption within the burner thus allowing more of the short

wave lengths to pass to the patient. The amount of absorption by the mercury vapor is, however, very slight.

Dobbie and Fox (Royal Soc. Proc. 98, 1920, 147) in studying the visible and near ultra-violet regions found that mercury vapor absorbed but few rays at any temperature.

Hughes found that one cm. of water was opaque to wave lengths shorter than 2200 Angström units.

Quartz, either crystal or fused, varies in transparency.

Kreusler found that water absorbed 69% of wave length 1860, 25% of wave length 1930, and 14% of wave length 2000 Angström units, while at 3000 the absorption was but 2.5%.

Mme. Henri found that ultra-violet intensities increase with the increase of temperature within the burner and that the intensity of ultra-violet output decreased markedly when the burner was cooled by water.

Cleaves says, "These experiments conclusively established that while quartz transmits the bactericidal frequencies, its use with a water-cooling device renders the apparatus less active."

Our own experience, covering ten years of active use of the quartz lamps, is that the higher voltages, which give greater heat within the burners, give the greater intensities of ultra-violet output. Accordingly, we use not less than 70 volts through the quartz burners and frequently 85 volts.

The above shows some of the experimental work done in an effort to clear up the point of air and water absorption of ultra-violet frequencies. Be that as it may, the results in practice prove that there is a much more intense hyperemia produced in a much shorter time with the water-cooled burner on a 110 volt circuit with 70 or more volts passing through the burner. At this voltage with a burner that is new or nearly so and in good working condition, a slight blister should be produced on a protected portion of the body in ten seconds, the face of the lamp being in contact with, but not compressing, the integument.

Browning and Russ found that the greatest bactericidal action lies within the middle ultra-violet region from 3000 to 2000 Angström units, while the most intense portion of these frequencies lies between 2450 and 2800 Angström units and is most powerful around 2553. They exposed staphylococcus pyogenes aureus for three and one-half hours and found that the limits of germicidal action were 2150 and 2960 Angström units.

Henri found that the most destructive action was around 2800 Angström units. They also found that the resistance of various bacteria varied considerable, fifteen to twenty seconds being sufficient to kill bacillus coli, while bacillus subtilis required from thirty to sixty seconds.

Henri (Comp Rend. 135, 1902, 315) found that absorption and abiotic action may be taken as indicative of each other. The

abiotic action is most powerful around 2000 Angström units, rapidly diminishing from 2100 to 2300, and from 2500 to 3100 the action is slight and apparently ends near this frequency. Thus it will be seen that the various experimenters differ somewhat in regard to the most active frequencies, but all agree that the bactericidal frequencies of greatest intensity lie between 2000 and 3000 Angström units.

Bazzoni found the killing effect of the total radiation from the quartz mercury-vapor lamp to be much more rapid than that from isolated wave lengths, which was probably due to the bactericidal action of frequencies associated with the isolated ones which he tested.

Bacteria are killed in a clear solution or on a clear solid media in about the following order:

	Seconds	Wave Lengths
<i>Bacillus coli communis</i>	1 to 20	2200 to 3050
<i>Gonococci</i>	6 to 10	
<i>Staphlococcus pyogenes aureus</i> ..	10 to 60	2380 to 2960
<i>Staphlococcus pyogenes albus</i> ...	10 to 40	
<i>Tubercle bacillus</i>	12 to 30	
<i>Streptococci viridans</i>	14 to 30	
<i>Streptococci hemolyticus</i>	14 to 30	
<i>Streptococci mucosus</i>	14 to 30	
<i>Pneumococci</i> (four groups).....	15 to 30	
<i>Diphtheria bacillus</i>	15 to 30	
<i>Influenza bacillus</i>	18 to 30	
<i>Bacillus subtilis</i>	30 to 60	
<i>Bacillus typhosis</i>	20	2100 to 3000

Hertel states, "Diphtheria toxins were destroyed in five minutes but the anti-toxin was not destroyed in one-half hour."

Lines 3340 and 3650 have a strong bactericidal action, although the exposure to kill must be continued for several hours. There is a definite bactericidal action from 3650 to 1860 Angström units which increases as the wave length decreases. The bactericidal action of these longer wave lengths explains the bactericidal effect of sunlight.

Moore* (1905) obtained the following results with the quartz mercury-vapor lamp: "Fresh bacteria in emulsions of normal salt solution or water when exposed to the carbon arc at a distance of three feet were not killed in fifteen minutes.

"In similar preparations of the same strains of bacteria exposed twenty inches from the quartz mercury-vapor lamp the live organisms were markedly diminished in five minutes and practically all destroyed in from fifteen to twenty minutes.

"The same organisms when prepared in emulsions of beef broth and peptone water solution were apparently but little af-

*J. J. Moore, University of Illinois College of Medicine; Personal Communication.

fects after exposures of thirty to sixty minutes. Some substance in these solutions appeared to protect the bacteria from the lethal rays.

"The bacteria employed in one experiment were bacillus prodigiosus, bacillus coli communis, bacillus cloaca, streptococcus hemolyticus, staphylococcus viridans and staphylococcus pyogenes aureus.

"The rays of the quartz mercury-vapor lamp had a greater bactericidal effect upon the cocci than upon the bacilli."

Larsen showed that the bacillus typhosis, diphtheria, plague, and splenic fever have very little resisting power, while tubercle bacilli and staphylococci offer greater resistance.

A. M. A. Journal (Vol. 84, No. 5, Jan. 31, 1925, pp. 379) published the following:

"Long Light Waves are Bactericidal. A study of the bactericidal action of ultra-violet rays has been made by the Bureau of Standards, Department of Commerce, covering a range of wave lengths from just beyond the limit of the visible spectrum down to the shortest wave lengths emitted by a mercury-vapor arc in a quartz lamp. The shortest waves, when sufficiently intense, were found to produce death with an exposure of only one second. Longer wave lengths required a greater intensity and acted much more slowly; but a killing action was found to result even from waves as long as 365 millionths of a millimeter (3650 A. U. Author) which is almost as long as the shortest waves visible to the human eye. Prior to this experiment, doubt had been expressed regarding the ability of these longer waves to kill bacteria. Bacillus coli communis was used in the tests. The bacilli were put in a large volume of water, some of which was sprayed on Petri dishes. A quartz mercury-vapor lamp was used as the source of ultra-violet rays, screens being interposed to cut off successive spectral ranges of the wave lengths. Rays of sufficient intensity killed bacteria with an exposure of less than one second, using a 320 watt mercury lamp, at a distance of six inches. When the intensity was low, the killing action was retarded. In some experiments an exposure of seventy-five to eighty seconds was required. On still lower intensities there was some indication that the bacteria were stimulated instead of being killed. In tests made to compare the relative value of continuous and intermittent exposures, it was found that the killing effect was in proportion to the total exposure, whether this was given all at once or divided into several short exposures with periods of rest between."

Coblentz and Fulton found that the abiotic action of the quartz mercury-vapor lamp ranged from 1700 to 3650 Angström units, and this explains the bactericidal action of sunlight, although the radiation must be prolonged for several hours.

They found that short exposures of ultra-violet from the quartz mercury-vapor lamp did not produce a toxic effect in the culture media, but that long exposures with a high radiative in-

tensity did. They also found that the lethal action of ultra-violet radiations from the quartz mercury-vapor lamp was much more rapid when wave lengths of less than 2800 Angström units were used than when those used were longer than 3050. An estimated difference of ten times the rapidity was evaluated.

On page 680 B. S. Scientific Papers No. 495, Coblentz and Fulton conclude with the following: "It is shown that the energy value of the most active germicidal radiation from the quartz-mercury arc wave length of 170 to 280 $m\mu$ required to kill a bacterium is very small, beginning of the order of 19×10^{-12} watt or 4.5×10^{-12} g cal.

"A further deduction is that, in order to produce a rapid abiotic action (in one second) the radiant flux of the germicidal radiation from the quartz-mercury arc must exceed a certain threshold value, which is of the order of 25 microwatts per square millimeter. This is obtained at a distance of about 15 cm. (6 inches) from a 110 volt mercury in quartz arc lamp consuming about 320 watts (80 volts, 4 amperes) in the burner."

Hertel in 1905 exposed certain (type not given) bacteria to light waves of 4480 Angström units but it did not affect them either with or without eosin which has no absorption band at this unit.

Eosin in a 1:1000 solution has a maximum transparency between 3680 and 3900 Angström units. It has an absorption band at 5180. Eosin therefore is not effective in the ultra-violet frequencies. Wave lengths of 2800 Angström units *killed the same species in sixty seconds* without eosin. When Hertel used a wave length of 5180 Angström units and stained these bacteria with eosin, the effect was similar to the effect of the ultra-violet wave lengths of 2800 Angström units except that this action was a little slower, rating 70 to 90 seconds against 60 seconds for the ultra-violet alone.

This wave length of 5180 is in the blue-green region of the visible spectrum and has an absorption band for eosin. This wave length will not kill bacteria, neither will eosin alone, but the effect of the two used at the same time had a destructive action on this particular type of bacteria. Thus it will be seen that certain dyes are of benefit when the visible rays (7000 to 3900 Angström units) are used, but do not aid in killing bacteria when the rays from the ultra-violet region (3900 to 2000 Angström units) are used. Therefore if one did not have an ultra-violet producing lamp one could substitute visible or sunlight first staining with the dye the region to be treated. Even then it would be necessary to know where the absorption bands of the dye used were located in the spectrum.

Bayliss in 1918 made the following statement: "The reaction of certain small animal organisms to ultra-violet light obeys definite laws. A minimum duration of exposure is necessary, as there

is a limit of intensity below which no reaction occurs and this effect is independent of temperature."

As both air- and water-cooled quartz mercury-vapor burners give a spectrum reading from 6000 (yellow region of the visible spectrum) to 2000 in the ultra-violet region. Both can be used for their bactericidal action. However, the facts given in this chapter show that the wave lengths of the middle ultra-violet region (3000 to 2000 Angström units) are the most bactericidal and that more of these wave lengths reach the patient when the water-cooled lamp is used. This is made possible by cooling the burner so that actual contact with the patient may be had without danger of a heat burn and at the same time eliminating the absorption of the short wave lengths by the atmosphere. Therefore it is best, whenever possible, to use the water-cooled lamp for bactericidal effects.

When the air-cooled lamp is used for its bactericidal effect, it is necessary to have the burner a sufficient distance (about eight inches) to prevent a heat burn and the air in this space absorbs many of the shorter wave lengths, therefore the effectiveness of the lamp is diminished and a longer exposure is necessary. This exposure should be at least five times as long as with the water-cooled lamp, i. e. if the water-cooled lamp exposure sufficient to kill certain bacteria was thirty seconds, the air-cooled exposure would be for two and one-half minutes.

The water-cooled lamp is much more convenient as well as desirable to use for all local and focal conditions besides the fact that its rays are more active in the destruction of bacteria.

For nose and throat cases as well as for naevi, telangiectasis, and hemorrhoids the use of the water-cooled lamp is imperative. In these cases the effort is wasted if the air-cooled lamp is used.

CHAPTER XII

Infra-Red Rays.

In studying actinic rays as produced by the quartz mercury-vapor lamps, it is necessary as well as desirable to study the infra-red region of the spectrum which was first discovered by Herchel in 1800.

In 1361 John of Gaddesden treated the son of King Edward I for smallpox, using the red and infra-red frequencies in as many ways as he could develop with his meager knowledge. The results in this one case were successful. Gregory revived infra-red therapy in 1843. It was again brought to the attention of the profession in 1867 and 1871, but did not gain a foothold until Finsen used it in 1893, to be followed by Rood, Surgeon in the Royal Navy in 1897. Yet it is only within the past few years that we have been able to use these rays knowingly for therapeutic purposes, although we have always used both of them from the sun which gives 80% infra-red as against 52% from the quartz mercury-vapor, 85% from the carbon arcs, and 93% from incandescent carbon filament bulbs.

Since the dawn of civilization and the development of industries, we have been using the infra-red rays unconsciously as heat rays from various sources, for any heated black substance gives off these rays in varying percentages, depending largely on the intensity of the heat. The quartz mercury-vapor burners give approximately 52% infra-red, 20% visible, and 28% ultra-violet frequencies, but as quartz is nearly opaque to most wave lengths exceeding 7000 Angström units, but few of the infra-red rays from these lamps are available for clinical use. The infra-red region begins at about 8000 Angström units and extends clinically to beyond 150000 (Beckwith, Stanford University) Angström units. This, of course, leaves out the very long infra-red frequencies and the long Hertzian and the very, very long radio waves which are at this end of the spectrum.

Luckiesh divides this end of the spectrum just as he does the ultra-violet into the near infra-red from 7700 to 20000 Angström units, middle infra-red region from 20000 to 500000 Angström units, and the extreme infra-red region from 500000 to ∞. He also designates the wave lengths coming from the three general regions as ultra-violet radiations, visible radiations, and infra-red radiations, and if this classification is adhered to, much confusion will be avoided (see diagrammatic spectrum analysis, Frontispiece).

Sun light gives approximately 80% infra-red frequencies, 13% visible, and 7% ultra-violet on clear, bright, summer days in the open country. The proportion of infra-red frequencies is much greater in cities and on cloudy days. The ultra-violet frequencies are readily absorbed by dust or smoke, while the infra-red are not. Again the ultra-violet rays from the sun which reach the earth are never shorter than 2900 Angström units. Cold, rainy, cloudy days affect the general health and mental conditions of all animate life because of the absence of the short frequencies which are bactericidal and as water absorbs the infra-red frequencies, we then lack the heat rays as well. Water is nearly opaque to infra-red frequencies and quartz is nearly opaque to those of longer wave lengths than 8000 Angström units, therefore few infra-red rays reach the patient when the water-cooled quartz mercury-vapor is used. Eighty per cent of the infra-red rays are absorbed by the first three feet of water, while less than one per cent passes through twelve feet of the same substance. One centimeter of water absorbs all wave lengths longer than 14000 Angström units.

The commercial Crookes glass absorbs most of the infra-red frequencies. Cobalt-blue glass readily absorbs the near ultra-violet while a solution of copper sulphate absorbs many of the infra-red frequencies.

LeBon claims that the infra-red frequencies destroy chlorophyll and alters the color of some vegetables. Nagelschmidt found that the yellow, red, and infra-red rays penetrate the deeper human tissues. Steinmetz in *Radiation, Light and Illumination* says, "The largest part of the organism is water. Water is transparent for visible light, but becomes more and more opaque in the infra-red as well as in the ultra-violet, and again is fairly transparent for X-rays. Blood is fairly transparent for the long visible rays of red and yellow but nearly opaque for the shorter violet and ultra-violet rays, hence next to the X-rays which pass through the body, the longest visible red and yellow rays penetrate relatively deepest into the body, although even they are practically absorbed within a short distance from the surface, thus while the energy maximum of sunlight is in the infra-red, the maximum physiological effect probably is that of the red and yellow rays, the same which are the active rays of plant life. The violet and ultra-violet rays are absorbed close to the surface of the body by the blood, which is opaque for them. Where intense radiation is intercepted by a body, clinical action may result from the heat energy into which the radiation is converted. The action of the infra-red radiation on plant life seems to be chemical action and this would be the most important of all chemical actions, as upon it depends the life of all vegetation and hence of animal life and thus of our own lives."

Abney was able to photograph the infra-red region up to 27000 Angström units with a special bromo-silver emulsion, thus

proving that these frequencies have chemical properties. The emulsion was developed by himself. Langley has since then produced the best photographs of the infra-red region.

As these rays are absorbed, they produce heat at the point of absorption. This mild hyperemia is of value as a sedative because of its action in relieving stasis. Pain has two main etiological factors, first, pressure of nerve filaments, and second, irritation of these same filaments by toxic products of the system, by those excreted or secreted by invading bacteria, or by poisonous elements assimilated.

The long, slow frequencies have their use physiologically in biology and if this be true, then they are of definite value therapeutically in restoring pathological conditions to normal. The infra-red, red, orange, and yellow wave lengths have no perceptible action on bacteria, while the wave lengths from the blue down through the middle ultra-violet either injure or destroy them. Again in the Schumann band and beyond through to the shortest radium waves there is very little if any bactericidal action so far as known at this time. Millikan (Institute of Technology, Pasadena, California) has plotted the region from the Schumann band to the L Series of X-rays (905 to 200 Angström units) but the bactericidal qualities of this region have not been tested and at present we have no way of producing them except in a vacuum.

The infra-red rays are produced by heating any black body although a perfectly black body is, at present, unattainable. This heating may be done artificially or naturally by absorption of the infra-red rays from the sun by any black body. When the human body is heated by the sun's rays, the deep tissues act as a black body, thus absorbing the infra-red rays. Once absorbed the infra-red energy is dissipated as heat into the surrounding atmosphere until an equilibrium is established. The rays from a heated black body can be reflected, concentrated, and refracted from any non-absorbing body or material. Any substance which does not absorb infra-red rays either allows them to pass through without heating or if impervious to them reflects them to other substances which do absorb them.

Therapeutics of Infra-Red Rays.

Neither glass, quartz, nor water should be placed between the infra-red generator and the patient; likewise clothing which absorbs infra-red energy should be removed before starting the treatment.

These treatments may be given in two ways. First, the short intensive treatment where relaxation is required, as in strictures, recent strains, bruises, dislocations, and all the various traumas. Second, the prolonged mild treatments which are useful in neurasthenic conditions, painful diseases as arthritis, neuritis, and

neuralgia, and the deep congestions and inflammations in various parts of the body.

The short, intensive treatments may be given in an office, but the prolonged, mild treatments are for use in the home or hospital and may well replace the hot water bag, hot sand or salt bags, the electric pads, etc. Although all of these have a place in the treatment of the sick, they should be relegated to emergency use.

As the infra-red rays are long, slow rays, they act accordingly and immediate effects should not be expected. As far as is known at this time there are no contraindications for their limited use, but for their prolonged use from bright sunshine they must be used cautiously or overheating of the body will occur and the heat regulating mechanism in the brain at the junction of the pons and medulla oblongata will be temporarily and in some cases permanently disarranged, thus producing what we know as sun stroke and the subsequent susceptibility to sunlight.

Remember that the human body is composed mostly of water and that water is a great absorber of infra-red frequencies and absorption of these frequencies means the development of heat regardless of the absorbing agent.

Solar heaters are effective even on cloudy or foggy days because of their absorption of the infra-red frequencies which penetrate clouds, fogs, and smoke in very appreciable degrees.

The prolonged intensive use of these rays as in active pulmonary tuberculosis with cavity formation, should be carefully watched on account of the deep hyperemia which they produce and which might increase the liability of hemorrhage.

They stimulate the growth of tissue largely by the hyperemia they produce, due to the absorption of infra-red energy which, when absorbed, produces heat energy. They are thus indicated in all chronic slow healing diseased conditions.

The depth to which the infra-red rays penetrate living human tissues has not been ascertained, but it is deep enough to affect deep congestion and inflammations. These rays are safe for both external and cavity use.

CHAPTER XIII

Catalysis.

Berzelius in 1835 defined catalytic action.

Ostwald in 1912 gave the following definition: "A catalytic agent is that material which affects the velocity of a chemical reaction without appearing in the final product."

Many things influence the rapidity of the action of any catalyst. The amount of the catalyst influences the rapidity of its action up to a certain point and then true to the law of diminishing returns, it is less influential. The true catalyst needs to be used in very small quantities, just enough to start the reaction. It must be remembered that this action can be stopped or poisoned by other substances.

Enzymes are true colloids. Enzymic action is a true catalytic action which may be inhibited or destroyed by heat, chemicals, etc. There is no doubt that the action of the actinic rays is catalytic. These rays are rapidly and almost wholly absorbed by the sterol products of the skin and the blood stream and while they probably are not carried as actinic rays by the blood stream, they start a chemical reaction which is carried to every cell in the body. In this way the various deeply placed tissues are favorably influenced.

Bayliss, in *Principles of General Physiology*, states: "A theory has been developed by Bodenstein (1913) according to which the first effect of light is to decompose a group into electrons and electro-positive remainder. Each of these gives rise subsequently to chemical changes of a particular kind. A fact common to all photo-chemical reactions may be mentioned here, namely, that the action of light is similar to that of a *high temperature*.

"In the first place, we find that the rate of the reaction does not follow the simple law of *mass action*. This is due to the fact that it is controlled by the amount of light energy absorbed per unit time and not by the actual number of molecules present. An instructive case is that of the oxidation of quinine by chromic acid in light, as investigated by Luther and Forbes (1909). The order of this reaction depends on the colour of the light; violet light is only slightly absorbed and the reaction is unimolecular, while ultra-violet light is strongly absorbed and the order is very much lower; since this light is totally absorbed, the rate of the reaction is independent of the concentration of the reacting substances.

"The initial phase of all photo-chemical reactions is accomplished by the actual consumption of light energy to set in motion a reaction, although it may afterwards proceed with the evo-

lution of energy. We have seen in Chapter Ten that a catalyst adds no energy to a reaction system, but merely accelerates the *rate* at which such a reaction arrives at equilibrium. Further, in many reactions, such as the decomposition of carbon dioxide by the green leaf, the reaction is actually caused to proceed in the direction opposite to that in which it goes naturally at the temperature of the reaction. But, in many cases, a catalyst is formed by the action of light, and this catalyst then proceeds, independently of the light reaction proper, to perform its usual function of accelerating the natural course of the reaction. In this case, contrary to that of the chlorophyl system, the net result of the change is a diminution in the free energy of the system.

"In photo-chemical changes—before the stationary condition is reached, part of the light energy becomes chemical energy. Another example is that of the formation of ozone from oxygen by ultra-violet light.

"A striking fact, which may appropriately be mentioned here, is that the *temperature coefficient* of a light reaction is usually much lower than that of a chemical reaction proper. This follows from the fact that the rate of the photo-chemical change depends on that of the absorption of light, which varies only very slightly with temperature.

"Decay dissolution starts a reaction which goes on independent of itself. One of the best known of all catalytic light reactions, namely, the combination of hydrogen and chlorine under the action of ultra-violet light, belongs to this group. A great number of investigations have been made on this reaction since the first exact research by Bunsen and Roscoe (1855-1859).

"Compared with the reactions in which light energy is stored up, and often in considerable amount, these catalytic reactions require little energy to form the catalyst, and are, as a rule, very sensitive.

"Dyes increase the absorption of certain light rays within the tissues, hence increase the reaction.

"Iodine set free by light remains active after the light has ceased to act, and continues so for several days. Moreover, if a solution which has been exposed to the light be added to an unexposed one, decomposition of the latter sets in.

"The capacity of being developed at any time after exposure, possessed by photographic plates, is another case. We cannot here discuss the nature of the latent image. The reduction-potential of the developer is not sufficiently high to effect unexposed silver bromide at any considerable rate; but, where the light has formed a catalyst, metallic silver is produced in development. It appears that the acceleration is due to absorption of developer on the surface of the heterogeneous catalyst, by which the concentration of the former is raised and, with it, the reduction-potential.

"It is clear that, in these cases of catalytic action, if we could add the catalyst in any other way than by the action of light, the results would be the same. This is not so in the three first cases of our list, where the same products of reaction as those produced by light cannot be obtained in the dark, at the same temperature, by other means.

"It was shown by Hardy that the negatively charged B-particles of radium produce coagulation of oppositely charged colloids, and the effect appears to be an electrical one."

In this connection it is certain that only the absorbed rays are active, that is, they are the only ones which produce results, either constructive or destructive. The constructive results are brought about by chemical changes which are started by the actinic rays inducing a retrograde process in a pathological cell. Now then, if we continue an actinic-ray application long enough, we increase the pathology of the cell or produce it in a normal cell, hence the action is dependent upon the length of the light waves, the length of the application, the contiguity, and the present character of the tissues being rayed.

Catalytic light reactions in some substances can be started or stopped at will, simply by turning the light on or off, proving, in these instances, the catalytic action of light, also proving that this particular catalytic action is an immediate, not a continuous one.

In other instances the catalytic action of light is stored up for future use; however, this use must be continuous and not intermittent.

The vibrations of the negative electrons have the same wave length as the actinic rays which influences their absorbability.

Certain bodies or chemicals have the property of fluorescing when exposed to actinic rays, which property may yet be used advantageously but, if so, it has not been developed at the present time.

Bovie, in a paper (The Journal of Medical Research, Vol. XXXIX, No. 2, November 1918) on The Localization of the Physiological Effects of Radiation Within the Cell, says in part: "If two kinds of radiation have a difference in penetrating power such that the effects of the one are strongly localized near the surface of incidence, while the effects of the other extend deep into the organism, obviously there will be a difference in the physiological effect produced. Our information concerning the penetration of ultra-violet radiation into tissues is indicative of a sufficient difference in the penetrating power of the rays used in the experiments referred to above to account for the observed differences in physiological effects. It seems reasonable, therefore, to postulate that the differences are due to a difference in penetrating power rather than to any action specific for wave length. By selecting

rays of proper penetrating power, we have localized the place of action within the cell. The basic principles of the method are applicable to the study of the action of rays in general, and an extension of their use will, it is believed, open up new lines of biological investigation.

"The localization of the place of action of radiation within an organism is comparable to the localization of the action of drugs in modern chemotherapy as developed by Ehrlich and others. For the comparison, consider some of the basic principles of chemotherapy. In chemotherapy, the localization of the action of the drug is due to its accumulation in certain tissues or tissue elements, somewhat in the manner as a very slight and uncertain color in a solution can accumulate and become distinctly visible on a woolen thread. When the accumulation is not made evident by visible changes in the tissues or by post-mortem chemical tests, it may be inferred from disturbances in the functions of the accumulating tissues. For such information as this, we are, of course, indebted to the present state of development of anatomy and physiology. Naturally, we must determine by experiment in the individual case whether the accumulation has occurred in the organ affected or in some other controlling tissue. Moreover, the specific functional disturbance may not necessarily be due to selective accumulation, but rather to a hypersensitiveness to the influence of the drug, on the part of the tissue in question. The localization of drugs has not, as yet, been extended to include localization within the structure of the cell.

"The localization of the place of action of radiation within the organism depends upon two principles; first, selective absorption of rays, and, second, hypersensitiveness to the influence of rays. The application of the principle of selective absorption will be made possible by determining the absorption of radiation by different kinds of tissue elements. The application of the principle of hypersensitiveness to the influence of rays will be made possible by careful physiological studies of organisms which have been radiated. In connection with the absorption of rays it must be pointed out that absorption alone cannot be used as a measure of physiological action because physiological action does not depend upon the amount of energy absorbed, but upon the kind of processes initiated through the transformation of the absorbed energy.

"Whether selective absorption will take place depends upon the kind of radiation used and the nature of the absorbing tissue. The laws of absorption of radiation have been discussed in a previous paper, but for the sake of completeness they will be repeated here:

"When both tissues and the radiation are homogeneous in character, then, according to Lambert's law, each layer of tissue of equal thickness absorbs an equal fraction of the radiation which

traverses it. Hence, as the thickness of the tissue increases in arithmetical progression, the radiation intensity decreases in geometrical progression,

"For all ponderable matter there is a strong absorption band in that part of the spectrum which separates the ultra-violet region from the Rontgen region. It follows, therefore, that the absorption index of the components of protoplasm rises to very high values as we approach this band from either the ultra-violet or Rontgen sides, and that the absorption index of protoplasm increases with decreasing wave length in the Rontgen region of the spectrum,

"It is quite impossible to say a *priori* whether such an increase in absorption will be accompanied by an increase in the physiological effect, because we do not know the mechanism by which the energy of the rays is transformed into physiological action. If the increased absorption were due merely to an increase of molecular concentration in the absorbing region, and further, if the amount of physiological action were proportional to the degree rather than to the concentration of photochemical change, it is possible that no increase in the physiological effects would be observed. If, however, the increase in the absorption index were due to a difference in chemical composition of the absorbing medium, an increase in physiological action might reasonably be expected.

"Our knowledge of the physiological effects of radiation is not sufficient to enable us to lay down fundamental principles concerning the hypersensitiveness of different kinds of protoplasms to the influence of rays. We know that some kinds of protoplasm, such, for example, as that composing the so called 'eye spot' of the single-celled organism, *Euglena*, are extremely sensitive (as compared with other parts of the cell) to the influence of light rays. In this case, the hypersensitive region is provided with a pigment which increases absorption. Whether it is the pigmented protoplasm itself or the protoplasm closely associated with it, which is hypersensitive, has not yet been determined.

"There is some evidence that certain parts of most cells—the nucleus, for example—are more sensitive to the influence of rays than other parts. Again, cells in a rapidly growing condition appear to be more sensitive to radiation than cells which are at rest. Evidence concerning these matters must be carefully examined, however, before categorical statements of hypersensitiveness can be made, because our knowledge of the functions of the cell is limited, and what may appear to be specific hypersensitiveness may be nothing more than an expression of the limitations of our experimental methods. We observe disturbances of functions only where we know how to look for them,

"Investigations made by myself and others on ultra-violet photomicrography, using quartz rays of wave length 2800 Angs-

tröm units, have shown that these rays penetrate the cytoplasm of *Paramecium* quite easily and are strongly absorbed by the nucleus, particularly by the chromatin,

"The localization of the physiological effects of quartz rays may not be due entirely to the high absorption index of these rays in the nucleus. The nuclear mechanism appears to be hypersensitive to the influence of radiation, for an exposure to the rays from the radium emanation is followed by physiological disturbances similar to those produced by quartz rays."

CHAPTER XIV

Radium.

Radio-active substances were first discovered in 1896 by Professor Becquerel of Paris when he placed a piece of uranium on a photographic plate which was covered with a light-proof paper and later found that the plate was fogged, although it was not until 1898 that M. and Mme. Curie separated and gave a name to the element radium.

Radium is not a stable element, but is one of the transmutation stages of the element of uranium, which in itself may be a transmutation stage of some other element, all of which brings up the discussion as to whether or not all elements are not transmutation stages; however, this is all speculation.

There is definite proof that some thirty different substances are radio-active and these have been proved to be transmutation stages. At present there are three separate elements which are the parents of these thirty elements: Thorium, which gives off mesothorium and radio-thorium and whose end product is lead. Thorium has a half-decay period of twenty-three billion years, while mesothorium has a half-decay period of about seven years, and radio-thorium about two years.

Uranium has a half-decay period of about five billion years and after four transmutation stages gives off radium with a half-decay period of about seventeen hundred years. Its final product is lead. Actinium, which is the third parent of radio-active substances, starts as a branch of uranium II, which has a half-decay period of about one million years, while actinium has a half-decay period of about thirty years, and the end product is lead, which leads to the speculation as to whether or not uranium, and indirectly actinium, are not products of transmutation from thorium.

The early and probably the majority of the analyses of radio-active substances have been done by Rutherford, Soddy, and Finzi, though many others have been and still are working toward further analyses of the effects of radio-activity. McCoy and Boltwood have shown that there is a definite proportion of uranium to radium in the natural state. This proportion they determined to be one gram of radium to three million grams of uranium. The smallest quantity of radium detectable by present methods is one fifty-millionth of a milligram.

M. and Mme. Curie extracted the first radium from pitchblende obtained from Joachimsthal in Bohemia. Later there were richer deposits of uranium-bearing ores discovered in Colorado, U. S. A. In 1917 a very rich deposit of uranium-bearing ore was found in the Belgian Congo.

The pitchblende deposit in Joachimsthal was 1% radio-active, that in Colorado was 2% radio-active, while that found in the Belgian Congo was 80% radio-active.

While many minerals contain small deposits of uranium, the two which contain it in commercial quantities are uranite and carnotite. The former is found in Bohemia and Colorado, while the latter is found in Wyoming, Colorado, and the Belgian Congo.

Carnotite was named after the French chemist Carnot and was discovered in 1899 by Friedel and Cummence.

What we physicians are directly interested in is not the theories of transmutation, but the product radium and its first decay product, the emanation which was so named by Sir Earnest Rutherford, but as it was somewhat misleading it was later renamed *niton* by Sir William Ramsay. Niton is a gas and was so named to identify it with the argon gases. Whether one uses the radium for direct application or the emanation, it is always the emanation and its transmutation products, radium A, radium B, and particularly radium C, which are the active agents. Radium without these decompositions or transmutation products would be valueless.

Emanations have an average life of 5.6 days and radium A gives off alpha particles only that have an average life of 4.3 minutes, while radium B gives off very soft beta particles having a life period of 38.5 minutes. Radium C gives alpha, beta, and the gamma rays, which we as clinicians are particularly interested in. These radium C particles have a life period of 28.1 minutes.

Soddy says: "It is probable that the change is complex and that the beta and gamma rays are given off in a separate change to that in which the alpha rays result." Quoting further from Soddy, "One of the most interesting points of the above scheme is to show that the beta and gamma rays do not come from radium itself any more than they do from uranium itself, but from the later products. It is loose but convenient to talk of the beta and gamma rays of radium. Really we mean the beta and gamma rays of radium C. The emanations, like radium itself, give only alpha rays. The whole of the beta rays result in the later changes of the active deposit. We have seen that, freshly prepared from solution, radium salts give only the alpha rays. The beta and gamma rays make their appearances only after the subsequent products have accumulated."

By using a negative field, Soddy showed that the active deposit of the transmutation stages of radium A, B, and C could be transferred to a needle point from which it could be transferred to a piece of emery cloth by wiping it once over the needle point containing the active deposit, which has a half-life period of less than one hour.

Radium itself is not used therapeutically, but one of its salts. For plaques, tubes, and later metallic needles, the radium sulphate,

which is insoluble, is usually used, although the bromide may be used in its place. For the commercial production of emanations or niton gas, the radium chloride is the salt used, as it is soluble in water. The emanation is put up for therapeutic purposes in small sealed capillary tubes called seeds. These are accurately measured before they are used and each carries a quantity of from 1/10 to 1 millicurie or more, usually about $\frac{1}{4}$ to $\frac{1}{2}$ millicurie.

While the radium salt has a half-decay period of about 1700 years, the emanation has a half-decay period of about four days, though it takes one day after it leaves the parent body to attain equilibrium, while the radium salt takes thirty days to attain its equilibrium or its maximum of emanation productiveness.

The emanation of niton gas contains three principal rays or wave lengths in which we are particularly interested—the Alpha or A ray, the Beta or B rays, and last but not most essential, the Gamma or X-rays. All of these rays are complex but need not be elucidated here. The three main types, alpha, beta and gamma rays, differ in penetrability as do different alpha or beta or gamma rays. The latter, however, we are not directly interested in, but we are in the former, i. e. the difference in penetrative power of the three main divisions, the alpha, beta and gamma rays as they are given off by radium or as they are found in the emanation or niton gas. Their penetrative power is approximately 1, 100, 10,000 respectively.

Alpha Rays.

Alpha rays or particles have a double positive charge of electricity and are shot out from the radium atom at a velocity of between 10 and 18 thousand miles per second. They have very great ionizing power but no power of penetration. A sheet of writing paper or a thin layer of rubber or paraffin is sufficient to stop them; in other words, to absorb them. If nothing interferes with their progress they will penetrate air at standard conditions for about 3 inches. These particles are deflected by a magnetic field in a direction, counter clock wise. The alpha particle is a charged material atom. The alpha particles alone have access to the real interior or nucleus of the atom of matter. (Soddy.)

The negative electrons or beta particles move in orbits about the positively charged nucleus.

Alpha particles are the most intense ionizers. The beta particles have less ability to ionize gas or liquids, while the gamma particles have the least ability to produce ionization. This is explained by the difference in their absorbability, which takes us back to Grothus' law that "Only the rays absorbed are active." Gamma particles do not ionize directly but only by the production of secondary beta particles which occur when a molecule is struck by a gamma particle.

Beta Rays.

Beta particles are negatively charged electrons and are identical with the negatively charged particles from the cathode of the X-ray tube. As with the alpha particles, there are different kinds of beta particles which we are more interested in than we were in the different alpha particles. Beta particles are known as soft, medium, and hard, which refers to their power of penetration. The hard beta rays are half absorbed by 0.1 millimeter and completely absorbed by 2 millimeters of lead or one-half inch of soft tissue and therefore cannot be used except for surface application. One millimeter of lead is sufficient to absorb the vast majority of these particles.

The soft beta particles are comparable with the alpha particles in penetrability, while the hard beta particles have at least 100 times more penetrative power and have a velocity nearing that of light or 186,000 miles per second.

The medium beta particles lie between the soft and hard in both penetrative power and velocity. The beta rays have a range at normal atmospheric conditions of between 50 and 170 cm., depending upon the disintegration product from which they are ejected. These particles may be strongly deflected by a magnetic field but in the opposite direction (clock wise, Soddy) from the alpha particles as they are oppositely charged. The ionizing power of the beta rays is about 2% of that of the alpha rays, while the ionizing power of the gamma rays is about the same percentage as that of the beta rays. This, however, is largely due to the difference in the area reached by the rays. The total ionizing power of the alpha, beta, and gamma rays is probably nearly equal. Ionization may be described as the shattering of the electrically neutral molecules of a gas or a liquid into oppositely charged particles.

Gamma Rays.

The gamma particles are the ones we, as therapists, are most interested in, as they cannot be deflected by any magnetic field so far produced. They are electro-magnetic waves which travel with the velocity of light and in straight lines. Gamma rays, like betas, are divided into soft, medium, and hard rays. The soft gamma particles from the X-rays have a wave length of from 8 to 0.5 Angström units, while the hard gamma rays from radium measure from 1.2 to 0.07 and undoubtedly much shorter, but beyond 0.07 they have not been measured, as we have no method of resolving them.

Soddy states the following: "The existence of rays so short in wave-length and high in frequency points to a revolution of electrons in the atom in orbits of excessively minute diameter, so minute that the question arises whether the X-rays do not really originate from the electrons actually contained within the atomic

nucleus. These results furnish another and independent proof that radio-active phenomena occur entirely in the atomic nucleus."

If the above be true, then the gamma particle absorption is an electronic phenomenon differing materially from the molecular absorption of the longer wave lengths of the visible or ultra-violet regions down to the Schumann band. Hard gamma rays pass through substances which absorb soft gamma or hard beta particles by virtue of the force propelling them, their small size and their non-deviability. When, however, they do find other particles with which they can vibrate in harmony, they develop what is known as secondary beta rays which have a penetrative ability of the hard beta rays or about one-half inch of soft tissue. Gamma rays also develop secondary beta rays when they pass through lead.

According to Sir Earnest Rutherford, the hardest gamma rays of radium are half absorbed by about 15 millimeters of lead or 26 centimeters of soft tissues, while they will penetrate 115 meters of air. Only the softest gamma rays are absorbed by brass, aluminum, lead, or steel. Gamma rays do not produce ionization directly but only by the development of secondary rays.

Alpha, beta, and gamma rays produce fluorescence and phosphorescence as do the longer ultra-violet rays. These rays produce photographic action but to a minor degree when compared with the X-ray.

The slight bactericidal action of these rays within the human tissue may be attributed to the development of some chemical property, as ozone, rather than to any direct action upon the bacteria. If the rays are used for a sufficient length of time to destroy the vegetable cell, the animal cells would also be destroyed. Notwithstanding the above statements, tubercular adenitis, is, many times, benefited by a stimulating dose of radium, which, however, does not destroy the tubercular bacilli direct.

X-ray and radium rays aid in the restoration of pathological tissue infested by bacteria when these same bacteria are not killed in culture media by these same rays therefore, it is assumed that roentgen and radium rays do not kill the bacteria directly when living and growing in pathological tissue. The X-ray and radium rays probably act either as a catalyst or by direct action on the body cell in restoring it to normal function, at which time it is able to destroy the bacteria. Anything which changes the chemistry of the pathological tissue cells, or the media immediately surrounding them, may render that food supply toxic to bacteria. On the other hand, anything which changes the chemistry of normal tissue or its surrounding envelope furnishes a proper media for certain bacteria. In other words, normal tissue chemistry does not furnish a proper media for the growth of pathogenic bacteria, although changes in its chemistry will. Various changes are necessary for various bacteria. When bacteria are living and propagating in a

certain media, a change in its chemistry will cause it to become toxic to that species of bacteria though it may not be to other species. This is easily tested out in the laboratory and is usually known as an antibody action. According to Dorland, antibodies include amboceptors, agglutinins, antienzymes, antitoxins, bacteriolysins, cytotoxins, hemolysins, opsonins, and precipitins.

There is no question but that the bactericidal action of radiant energy abides in the shorter wave lengths or ultra-violet portion of the spectrum. The wave lengths from 5000 to 3900 Angström units are feebly bactericidal, from 3900 to 3000 Angström units are more so, while from 3000 to 2000 Angström units they are most bactericidal; hence we see that the bactericidal action is a chemical one.

The development of spermatozoa is permanently interfered with following prolonged exposures to radium or X-ray. Integumental tissues heavily rayed with radium show two main changes, embryonic regression and fibrosis. In the first instance, there is destruction of the glandular structures with permanent epilation. In the second instance, there develops fibrous connective tissue, the fibers of which lie in parallel lines.

Renon rayed the splenic area of a case of myelogenous leukemia from which the spleen has been removed, which resulted in a lowering of the leucocyte count, probably due to the action of the gamma and beta rays upon the blood as it passed through the abdomen.

The destructive action of the rays from radium on the blood stream is to produce a transient leucocytosis followed by a marked leucopenia. The endothelial cells are proliferated and swollen, occluding the vessels either temporarily or permanently, depending upon the amount of radium used, the screening, and the time of application. Total permanent occlusion means destruction of tissue with necrosis.

The spleen, bone marrow, and lymphatic system are very sensitive to these rays, and the blood stream, particularly the white cells, is extremely sensitive to their action.

Nerve and brain tissues are relatively insensitive to radium rays, the changes being largely confined to the vascular supply. On the other hand, the prolonged use of radium or small frequently repeated doses eventually produces a burning sensation which not even morphin will stop, except temporarily.

Diathermy, medical or surgical, seems to offer most for these cases but must be continued daily for 30 to 90 days. Ultra-violet frequencies help some cases and temporarily increase the pain in others. However, the ultra-violet frequencies always aid materially in the restoration of tissue which has been damaged by X-ray or radium radiation. The burning pain complained of in these cases is doubtless caused by an irritation or inflammation within the nerve sheath, depending upon the amount of radium used, the screening, and the length of time applied.

The different cells of the body react differently to hard beta and gamma rays. The thymus, spleen, bone marrow, lymph glands, and granulation tissue, are the most sensitive, while nerve tissue is the least sensitive.

The radio-sensitivity of tissues depends upon their stage of mitosis, the chromatin content, and the number of undifferentiated cells they contain. The size and character of the lymph and blood vessels permeating the mass also have an influence on the radio-sensitivity. The thin walled recently formed vessels, with their delicate endothelial lining, are much more sensitive to radiation therapy than the older and thicker walled vessels. This explains why a thymoma, a rapidly growing lympho-sarcoma, the lymph glands in Hodgkin's disease, or an active tubercular adenitis, are extremely susceptible to radiation treatments. Squamous-celled epithelium is very sensitive to even a half hour's radiation with gamma rays. This length of time is sufficient to produce pain by irritation of the nerve filaments. Muscle tissue is fairly insensitive but when over rayed develops fibrous connective tissue. Fat is apparently quite insensitive to raying, although its blood vessels may become occluded and necrosis result therefrom.

Martland (Journal A.M.A., Dec. 5, 1925) reports a case of bone necrosis and death following the absorption of radio-active substances. The anemia in this case resembled acute pernicious anemia but from which it differed in its "rapidity, its lack of remissions, the absence of nervous and gastro-intestinal symptoms similar to that seen in the acute leukemias and the presence of buccal lesions with necrosis of the jaw."

The case had absorbed the radio-active substances years before, being by occupation a painter of watch dials. The radio-active substance that was used to make them luminescent had gained entrance through pointing the brush with the lips, thus a minute quantity was swallowed several times a day over a course of years. Martland was able to demonstrate, by the use of an electrometer sensitized to 0.001 of a microcurie, emanations from the breath, the liver, bone marrow, bone cortex, and spleen. He therefore cautions against the use of radio-active substances for internal or intravenous medication because of our inability to remove or modify a deposit of them within the tissues. He also reports another case, yet in good health, in whom he found radio activity in quantities measurable with an electrometer. This case also gave a history of exposure to radio-active paints. They have tried to influence the radio-active deposit by exposing the body to quartz-mercury light frequencies.

As the lymphatic system is markedly affected by radium, so also is sarcoma of the lymph glands. The lymphocytes are extremely sensitive to X-ray or radium radiation; hence, lymphatic leukemia is benefited by these radiations. Ultra-violet frequencies increase the number of lymphocytes which X-ray and radium

diminish by prolonged application. A stimulating dose of X-ray or radium may temporarily increase them. Apparently the cell nucleus is first attacked by beta or gamma radiation, thus the reproductive function is first to suffer.

In studying the effects of radium applications, it must be remembered that the container screens out the alpha particles, leaving only the beta and gamma particles to be considered, and as 1/10 millimeter of lead screens out 50% of the beta rays, even this slight screening leaves us but a part of the hard beta and the gamma particles to consider.

Rutherford states that 2 millimeters of lead will screen out all of the hard beta and the soft gamma particles. With this amount of screening we have but the hard gamma particles with which to deal.

Assuming that the ionization properties of the various particles of radium are the same in total area radiated by each division, i.e., alpha, beta, and gamma, it appears that the biological action is nearly equal; but as the container screens out the alpha particles and 1 millimeter of lead screens out most of the beta particles, these may be eliminated from farther consideration. Soddy says, "Radio-active bodies cause the air and other gases to lose the insulating power they normally possess and to become partial conductors of electricity. In consequence, any electrified object has its electricity rapidly discharged in the neighborhood of a radio-active substance."

This fact led to the development of the gold-leaf electroscope, "the first and simplest electrical instrument to be invented" and for the purpose of detecting radio-active substances even in minute quantities has no equal today.

In using the particles emitted by radium, the user must remember that these particles are constantly emitted, therefore he or she is in constant danger while handling or applying radium. Nothing so far has been found that will stop or change this activity for more than short periods, and this change is but apparent, being the removal of the emanation or niton gas which recovers its equilibrium in about thirty days. The emission of the different particles has been going on during this interval at the same rate as previously. All that occurred was to remove the present usable supply of particles. The equilibrium of the niton gas is the production of the particles equal to their destruction. While man cannot change or alter the actual radio-activity of radium, nature can and is gradually, but unalterably, transmuting both its parent uranium and its product niton.

As with X-rays, barium-platinocyanide screens are used to detect the ejected particles of radium by fluorescence. Enormous quantities of heat, per unit of radium, are developed, but as the quantity of radium used is so small, the heat effect may be forgotten as far as its therapeutics are concerned or its danger to those handling the element radium.

Hard radium gamma particles travel in straight lines and can not be deflected, and it takes an extremely thick filter or long distance to absorb them. These particles will penetrate lead a foot thick and air for a distance of 115 meters, and this is proved by their discharging a gold-leaf electroscope. Uranium has thirteen direct changes or transmutation periods through the radium line, all of which are intensely interesting to the physicists, but most of which cannot be used therapeutically, so the reader is again referred to Rutherford, Soddy and Finzi for details of these transmutation periods.

Mass is apparently made up of atoms which in turn form molecules, but going one step farther back, we find that the atom is made up of electrons. It is still a disputed point as to whether there are positive and negative electrons or whether all electrons are negative.

Soddy, Rutherford and others apparently believe that each atom has a central nucleus which carries a unit of positive electricity for each unit of negative electricity or negative electron, which surrounds and protects it. The negative units or electrons form orbits about the nucleus much as the solar system is formed. It is probable that the relative magnitude of the nucleus to the atom, is as the earth to the solar system. (Soddy.)

Millikan states the following: "How these free positive charges in the nucleus varying from 1 to 92 are held together we do not know. The experimental evidence at present stops with the fact that a number of free positive electrons equal to the atomic number exist in the nucleus and that a corresponding number of free negative electrons are held in equilibrium in the outer regions of the atom. We may imagine that there are some negative electrons also inside the nucleus, for they seem to be shot out from it in radio-active changes. Further, to take the case of the lightest of the composite atoms, helium, of atomic number 2, since its nucleus has but two free positive changes, while its atomic weight is 4, we may imagine that its nucleus is actually made up of 4 positive electrons which are held together by 2 negative electrons.

"In like manner, from this point of view, each nucleus would have a number binding negative electrons equal to its atomic number, and the number of positive electrons bound by them in the nucleus has but two free positive changes, while its atomic weight is two positives. This would leave, as it should, an equal number of negative electrons to be held in the outer regions of each atom. But plausible as this point of view may be, it is as yet speculative."

Soddy makes the following statement: "A charge of pure electricity entirely unassociated with matter, as the negative electron is believed to be, cannot be moved from rest without an expenditure of energy, nor if moving can it be brought to rest without yielding up its energy. It, therefore, must possess inertia or mass.

"That elements possess units of combining power, or 'bonds of affinity,' as chemists call them, is one of the numerous facts which has been, at least partially, explained by the discovery of the electron and the fact that electricity exists in atoms no less than matter.

"Inevitably this makes us view the atom itself as consisting essentially of a very small dense nucleus at the center of a relatively enormous and almost empty sphere of influence containing only electrons.

"The alpha particle we know to be a helium atom of mass 4 carrying two atomic charges of positive electricity. Or, more accurately, a helium atom is an alpha particle minus two electrons. In all probability the alpha particle is the simple nucleus of a helium atom, the central sun, as it were, alone and unattended by any electronic satellites or planets at all."

These alpha particles it will be remembered are shot out from radium at a speed about $1/10$ to $1/18$ that of light, or about 12,000 miles per second. Their range is extremely limited (about 10 cm.). They are very readily absorbed by even a sheet of paper and they are positively charged. On the other hand, the beta particles have a range of from 50 to 170 centimeters, depending upon the hardness of the particle. At normal atmospheric pressure they travel, according to their hardness, from 40 to 80% of the velocity of light; some of the hardest particles reaching 98% of the velocity of light. They are absorbed by 2 millimeters of lead, although they have 100 times more penetrative ability than the alpha particles.

The gamma particles have a range of over 120 meters, are not all absorbed by a block of lead a foot thick, they are not electrically charged, therefore cannot be deviated from a straight line, and have the velocity of light, or 186,000 miles per second. They have a penetrative power 10,000 times that of the alpha particles. These particles, alpha, beta, and gamma, are all ejected from radium and all are probably discharged from the nucleus of the radium atom.

That the atomic nucleus has the power of attraction has been demonstrated by using a positive electrical field to attract the negative electrons. They can be brought out of their regular orbit, and as the positive field is increased they are pulled farther and farther away until finally the positive attraction of the nucleus is not sufficient to draw them back into its orbit or atom and they become free to unite with any other atom having an unsatisfied particle.

Undoubtedly the power of chemical combination will be explained when we have solved the ability of an atom to either attract from or release to another atom one or more of its electrons. That the nucleus of the radium atom has the power of attracting to it a something, probably a light frequency, which gives rise to the enormous expulsive efforts brought about when those particles are ejected is an unproved conclusion.

We, as therapists, are vitally interested in the various frequencies of the spectrum and in this instance we are particularly interested in the very short wave lengths, the shortest that have ever been measured (0.07 Angström units) and probably a hundred times shorter than this, and these are to be obtained from radium gamma particles alone.

If the atomic structure is composed of a positive nucleus surrounded by negative electrons, and these negative electrons can be either attracted to or released from an atom, and if beta particles are negative electrons and gamma particles emit secondary beta particles when striking atoms or nuclei of atoms of other elements, and these secondary beta particles have the penetrative ability of the hardest beta particles or about 1.5 centimeters of soft tissues while the gamma particles can penetrate 26 centimeters of soft tissue and give off the secondary beta particles, it is then evident that very material changes can be effected in the human body.

The human body is composed of nineteen different elements, each of which is acted upon differently by the free negative electrons ejected by the radium atom, and as pathological tissue is of a different chemical character than normal tissues it will be seen at once that the proper application of this agent is no simple matter. To begin with, a small quantity of radium over a greater length of time does not produce the same results as a larger quantity for a shorter time, although the milligram hours may be the same, for the following reasons: We are dealing with an agent which, when in its container, ejects two radically different particles at many different frequencies. Thus a long treatment needed for deep structures would give too many of the beta particles near the surface while the deeper tissues would receive enough or possibly too few gamma particles. On the other hand, if a surface treatment was being given, the long treatment would carry with it too much deep action of the gamma particles. These various effects of the particles led to the use of various materials to absorb the unneeded portion. These various materials are known as screens.

While many materials may be used for screens, those in common use are in regular order lead, silver, brass, rubber, leather, wood, and gauze. The amount of screening necessary to absorb the different frequencies is given under the heading of the various particle headings.

Radium is marketed in various containers, but needles of non-corrosive steel or irido-platinum each containing from 5 to 12½ milligrams are the most mobile containers, for these can be made at will by the user into flat applicators, tubes or packs for surface or cavity use, or they may be embedded directly in the tissues. When so embedded, they should be about 2 centimeters apart and not necessarily parallel, thus raying all parts of the pathological tissue. When so embedded they should not be left for more than

twelve hours, average seven hours, except in very exceptional cases, and then necrosis is sure to follow.

When raying deep structures from the surface, as the esophagus, it is absolutely necessary to have the needles parallel in the container to get a uniform distribution of the gamma particles and so that subsequent applications may not overlap. In these instances, there should be a screening of at least $\frac{1}{2}$ millimeter of brass, 1 millimeter of lead, the balance of the screening to be wood or leather. The total screening should be at least 2.5 to 5 centimeters in thickness. With this screening, the beta and soft gamma particles as well as the secondary betas are absorbed, leaving only the hard gammas. With the screening, the application of 50 milligrams in each pack should be continued for twelve to twenty-four hours and should not be repeated in less than four weeks. Four such packs may be used at one time or 4800 milligrams hours given without excessive destruction. When placed in flat applicators or tubes, they are necessarily parallel, thus increasing the quantity in a given area.

At the present time, the emanation or niton gas is being marketed in capillary tubes which are called seeds and are usually permanently embedded in the tissues unless they slough themselves out. When so used, extreme care must be taken not to have too large a quantity in each tube or they will not only cause necrosis of the surrounding tissue but will produce a burning pain which will defy morphine to control. Diathermy, or total destruction of the area by electrocoagulation, is many times the only relief obtainable, although ultra-violet frequencies will at times be sufficient. Not only must the amount of emanation be accurately measured, but the seeds must not be too closely implanted. About $\frac{1}{4}$ to $\frac{1}{2}$ millicurie per seed and these not closer than 1, or better 2, centimeters apart. It is far better to use too small a dose than too large, for even small doses cause loss of the power of mitosis due to the action of the beta particles on the cell nuclei.

Stimulation of the growth of the cancer cell by the action of small doses of radium has not been proved and is scarcely possible in view of the action given above. However, radium should not be used in or on tumors which have necrotic areas within them, for these are excited to greater necrosis not by stimulation but by increasing the rate of necrosis. This is partly due to the destructive action of radium rays on the already badly damaged cells, and partly due to the increased bactericidal action from mixed infections which accompanies the necrosis.

Surface reactions from the use of radium direct or its emanation as a separate product, are produced by the absorption of their various wave lengths, but principally from the beta or soft gamma particles. These reactions vary according to the amount of emanations used, the length of the application, the distance, and the screening.

Distance is an important factor, for it acts as a screen by allowing the atmosphere to absorb many of the beta particles even if no other absorbing substance intervenes.

These surface reactions may be anywhere from the slightest hyperemia not discernible microscopically to active necrosis not only of the integument but of the underlying tissues including the bones. These reactions appear in from a few hours after the application of the radium or its emanation to several weeks after its removal and for this reason alone repeated applications, i. e. within a few days of each other, must be very carefully watched or the cumulative effect will be disastrous. The end result of massive radiations, which may not appear for several weeks, are destruction of tissue locally at the point of application and the more serious destruction of the blood stream and blood-making organs.

Reactions.

Deep radium reactions are anaphylactic in character, slight reactions may occur in sensitive persons after small doses of radium when applied on the surface, within cavities, or when embedded in tissue. Usually, however, these anaphylactic reactions occur after heavy doses of radium such as 50 to 200 milligrams for twelve to twenty-four hours or more. This would give 600 to 4800 milligram hours. Usually the first thing a patient complains of is anorexia followed by nausea, and if severe, vomiting. There may be a slight rise in temperature and some increase in pulse rate. There is considerable lassitude, at times even great prostration. These symptoms may come on within a few hours after the application of the radium or may be delayed a week or more, the average time is within seventy-two hours after applying the radium. They may last but a few hours if the treatment is stopped or they may continue for weeks.

The length of time these reactions continue depends upon several factors: first, the idiosyncrasy of the individual to these wave-lengths; second, the general physical condition of the patient (the young or aged and enfeebled cases are most susceptible); third, the amount of radium used, its screening, and the length of the application; fourth, the size and consistency of the tissues treated, i. e. a large soft tumor will cytolyze more easily than a small fibrous one; again, if the tumor contains necrotic areas, radium or its emanations will hasten this process.

Anaphylactic reactions are protein reactions and the reason they occur during or after radium treatments is because the action of these short frequencies is cytolytic and cytolysis begins at once with the application and continues for several months thereafter.

We figure that the gross (visible) effects continue for at least two months and the action probably continues for at least three months longer. This does not mean that radium cannot be

reapplied during this interval, but it does mean that the effect of the first application and all subsequent ones must be carefully considered before there is a reapplication. As in other anaphylactic reactions, the treatments consist in stopping the absorption, if this is possible, and in active elimination and supportive measures. First the application must be discontinued, then large quantities of pure water given, distilled water is probably the best in this instance, fruit juices may be added to make it more palatable. Milk products are of value both for their liquid content and food value. Food in the ordinary sense should be discontinued during the stage of nausea and should be returned to with caution, particularly proteins.

Light baths or hydrotherapy to increase skin elimination should be pushed, thus one saves the internal eliminative organs from overwork and direct damage by the poison excreted, as well as from possible bacterial invasion in the necrotic cases. Actinic frequencies from the quartz mercury-vapor lamps are invaluable in aiding in the restoration of the blood stream to normal and should be used daily from the time the radium application is begun, if large quantities of radium have been used. These frequencies will aid very materially in the restoration of devitalized cells during surface reactions and are never contraindicated, although they must be given in smaller quantities during the height of a reaction, for they too produce cytolysis of cells too far disintegrated for restoration.

For systemic reactions, use the air-cooled lamp at a distance of 70 centimeters for one, two, or three minutes daily. For local reactions, use either the air-cooled or water-cooled lamp; if the former, use at a distance of 25 centimeters (skin-target) for one to five minutes daily; if the latter, one-fourth to one minute daily in contact or a distance of one centimeter. For the telangiectasis following radium or roentgen ray destructive action, nothing equals the quartz mercury-vapor lamps. These conditions should be blistered with the frequencies of the water-cooled lamp; those coming from the air-cooled are too long to be effective in these conditions.

Drugs have no apparent effect on the anaphylactic reaction, but are at times useful for symptomatic treatment of these cases. The ones we have found most useful are magnesium sulphate, magnesium citrate, castor oil, sodium bicarbonate, potassium bitartrate, citrate, acetate or nitrate, nux vomica, strychnin nitrate, hydrastis muriate, phenolphthalein.

The reaction of mucous membranes to radium emanations is much the same as that of the integument except that in place of the yellow-serum blister, the mucous membrane shows a white or grayish-white blister much the same in appearance as the diphtheritic membrane. In addition to its color it shades off imper-

ceptibly at the margins which are red or purple, depending upon the degree of destruction. Here again actinic frequencies from the water-cooled quartz mercury-vapor lamps are the ideal treatment. One-fourth to one minute daily to twice weekly will be sufficient. Certain bodily areas are more sensitive to radium frequencies than others, i. e. the mucous membranes are more sensitive than the integument, while the integument of the hands of one working in the bright sunshine is less sensitive than that of one employed indoors. The macerated integument under a heavy breast, in the axilla, or the groin, is more sensitive than that on the open surfaces of the body and this applies to the frequencies from the quartz mercury-vapor lamps as well.

It must be remembered that radium emanations produce epilation even to a greater extent than does the roentgen frequencies. This epilation can, to some extent, be minimized by the use of the quartz mercury-vapor frequencies. The water-cooled lamp is preferable in this instance to the air-cooled. It is best to ray the area before using the radium as well as after, but where the case is not seen until after the radium treatment, good results may be obtained by the after treatment alone. The earlier the quartz mercury-vapor frequencies are used, the better the results, for very obviously if the matrices are all destroyed, no method of treatment will avail. These cases should be slightly blistered. The treatment should be given one to three minutes in contact, or at a distance of one inch daily to twice weekly.

In general, to avoid reactions treat the case cautiously until idiosyncrasies are eliminated, then follow the radium treatment with the quartz mercury-vapor frequencies at least over the treated area for small lesions and general over the body for systemic reactions. These frequencies should also be used for the secondary reactions following one or thirty years after the original treatment. For these secondary reactions, it is sometimes necessary to precede the quartz mercury-vapor treatment with the destructive action of high-frequency (Oudin or d'Arsonval) electric currents to remove necrotic, warty or keratotic tissues which the quartz mercury-vapor frequencies will not penetrate. The high-frequency treatments can also be used to remove the nerve impingement or destroy exposed nerve filaments which may have been causing an excruciating burning pain for months past. Absolutely nothing, not even morphine, equals this method of stopping these awful burning pains and it not only stops the pain, but aids materially in healing the lesion, particularly if it is followed by the use of the quartz mercury-vapor frequencies.

Before giving a radium treatment, it should be definitely ascertained if the case has been previously treated with roentgen or radium frequencies; if so, how recently and with what quantity, as well as the number of treatments. One case of roentgen ne-

crosis seen by the author had had a treatment every other day for two years for pruritis vulvae without epilation, but with ulceration into the cutaneous, subcutaneous, and muscular tissues of the inner surface of both thighs which when seen had been going on for three years. This case was healed in less than six months with the frequencies from the quartz mercury-vapor lamps, mostly from the water-cooled. The pain in this case, as in many others, was controlled with Butyn (2 to 5%) in petrolatum. In some cases, it is preferable to use oleum olivae for a vehicle for its nutritive effect, although the fact that it is absorbed is a disadvantage where it is desirable to exclude the air.

Treatments.

Having considered the physics of radium, the screening of its various rays, and the methods of application, we may now take up the treatment of the various pathological conditions which are amenable to this type of therapeutics. First, it must be remembered that radium is an adjuvant to other types of therapeutics, particularly surgery. In few cases it alone suffices. In non-surgical cases, it is used as an adjuvant, as are the frequencies from the quartz mercury-vapor lamps and for the metastasis in cases of malignancy where electrocoagulation was used to destroy the primary foci. In myeloid leukemias it is used to aid in the control of the *myelocytes* and in the reduction of the size of the spleen. It is frequently used as an aid in controlling metrorrhagias, particularly those accompanying fibromata and usually is sufficient for the absorption of the fibromata as well.

Splendid results are to be had with radium in the treatment of exophthalmic goiter and enlarged thymus either in children or adults. It is to be remembered, however, that an enlarged thymus gland after 30 years of age may mean cancer, either carcinoma or sarcoma, usually the former. Radium may be used in lupus, although for active destruction in these cases, we prefer desiccation with the Oudin current followed by the quartz mercury-vapor frequencies. The same may be said of tubercular adenitis.

Blastomycosis can be successfully treated with radium or its emanation. Sycosis also yields to radium but we prefer to use the water-cooled quartz mercury-vapor lamp for these cases. Hodgkin's disease may be treated with radium if the areas are small and the glands fairly well localized, otherwise it is best to use the X-ray.

Radium is valuable for naevi, especially the rapidly spreading or laking types. For the superficial types, the water-cooled lamp is all sufficient and after radium has destroyed the laking and the larger vessels, it is well to finish the margins with the water-cooled lamp.

For the technique of radium applications, the reader is referred to the various diseases in order to save repetition.

After a malignancy has broken down, radium many times aggravates the condition, particularly if the necrotic area is within the mass as in the submaxillary glands. On the other hand, it is a valuable agent for these same glands if used before the necrosis takes place. Sclerotic types of malignancy yield much more readily than the melanotic or the medullary types, probably because the latter types metastasize so early that treatment is of little avail except for temporary prolongation of life. The same may be said of any case of malignancy showing marked cachexia, which always means an advanced stage and usually means a general metastasis.

Inoperable cases of carcinoma must be divided into two general classes of cases, those without distant metastases which may be arrested, and those with general metastases wherein no known treatment will more than temporarily arrest the progress of the case. In the latter type, radium is valuable for the relief of symptoms for the control of hemorrhage, or the lessening of the odor, etc., but the patient or his family should be definitely informed that this relief is only temporary.

The intelligent use of radium requires surgical judgment, as complete a knowledge of histo-pathology as it is possible to obtain, and a broad biophysical training, therefore a close association with a competent pathologist is necessary.

CHAPTER XV

Diseases.

The case reports following each disease were selected because they typify that disease and the treatment given being an average one. They were made short for ready reference and are intended to be used as a guide. Although most of the cases given were partially or wholly relieved of their symptoms, it is not to be taken for granted that all patients are restored to health. In the description of the disease and its treatment will be found an estimate of the value of the physical-therapy treatment for that disease. With physical therapy as with drugs and surgery, many cases so treated do not recover.

Abscess.

Abscesses are both acute and chronic, or to put it differently, hot and cold and have for their etiology various pus producing bacteria.

An acute inflammatory infection gives as its cardinal symptoms heat, swelling, pain and when the inflammatory process reaches the skin, redness which becomes purple, just before spontaneous rupture takes place.

The location of an acute abscess may be in any part of the body and in any tissue of the body, hence they are named according to the location and tissue involved.

Cold abscesses are usually tubercular and as their name implies are not acute or inflammatory. Their destructive process is very slow, taking months for the destruction of the same amount of tissue that would be destroyed in a few days by an acute process.

Tubercular abscesses may be primary in any tissue of the body, but are most common in the spine, where they are called Pott's disease, psoas abscess, etc. Their next most likely location is in the lymphatic glands and in a large majority of cases in the cervical lymph glands. Their involvement is probably secondary to tonsillar invasion by tubercular bacilli.

One point to be remembered in connection with tubercular infections of joints and bones is that articular surfaces are first to suffer and first to be destroyed. The destruction of the shaft is secondary. This point makes a nice differentiation when the question of a malignancy occurs, for the malignancy will destroy the shaft or body of the bone before it attacks the articular surface.

X-rays are of value in diagnosing these conditions only after destruction and displacement have taken place and not before. The Von Pirquet test is of value in children but not in adults. Be-

fore the tissues have broken down, nodules on the mass aid in diagnosis but are not pathognomonic.

There is but little if any pain or real discomfort to the patient in the early part of a tubercular lesion, but this alone should help guide the careful diagnostician in his search for hidden trouble. Early and correct diagnosis of any infective process is of the utmost importance as a guide to the correct treatment of the ailment.

Treatment. All abscesses should be drained as the first step in their treatment, regardless of their location or the type of infection if this is at all possible, for in no other way can the destructive process be curtailed. This does not mean that they should be laid open from one side to the other, but rather that the opening be sufficient to permit the debris free exit. With the pus near the surface, a tenotome opening is sufficient, while if there are large masses of necrotic tissue the opening should be large enough to permit them to flow out without irrigation or pressure. Once opened, drainage must be maintained until the cavity heals from the bottom outward. This is best accomplished by the use of drains or rubber tubing, gauze, or strips of gutta percha, according to the size and location of the abscess. These drains should, however, be removed at the earliest possible moment after the drainage tract is established which in most cases is just a few days.

Bone abscesses require simple drainage unless sequestra are present, then they must be removed.

The following cases are illustrative of our methods of treating abscesses:

Case No. 730B. Female, age 27. Came to us December 18, 1919, at which time she had eleven loose teeth which a roentgenogram showed to have alveolar absorption or apical pockets.

Began treatment by having her dentist clean and polish all the teeth thoroughly and with instruction to watch the teeth during the treatments. Began the actinic-ray treatments with the water-cooled lamp, using a 13/16 inch solid quartz rod for an applicator. The treatments were of one minute's duration for both inner and outer surfaces of both upper and lower maxilla. The frequency was twice a week.

There was steady improvement of both local and general condition, but at the end of the first thirty days it was thought best to add general body treatments with the visible light and actinic rays. The treatments were continued twice weekly. At the end of three months three of the loose teeth had been extracted, the balance were sound and firmly attached to the alveolar process and her general health was very much improved.

DIAGNOSIS: Apical Abscess.

Case No. 722. Female. The patient came to us April 22, 1924, suffering with a peritonsillar abscess. In January 1924, she had a double parotitis. In February, 1924, she had influenza. In March she notice a swelling starting in the cervical region behind the angle of the left lower maxilla. When she came to us it had extended nearly to the clavicle.

She was sent to the National Pathological Laboratories for a blood count, which was as follows: Hemoglobin 78%; erythrocytes 4,500,000; leucocytes 22,200; small mononuclear leucocytes 20%; large mononuclears 4%; polymorphonuclears 74%. The abscess was opened the next day at the hospital. Drainage was established posterior to the mastoid muscle and into an abscess in the deep chain of lymphatics. On April 24th she was given a two minute actinic-ray treatment with the air-cooled lamp. The swelling and redness began to disappear after the first treatment. Following this she had treatments April 25th, 26th, 27th, 28th. She left the hospital on the 28th. There was very little drainage and the cavity was healing rapidly. She had a treatment April 30th, May 1st, 5th, 9th and 16th, when she was dismissed entirely healed and in normal condition.

DIAGNOSIS: Peritonsillar Abscess.

Case No. 698. Female, age 48. Started treatment August 8, 1922. Four days before she noticed a small, hard, tender mass in the left ischiorectal fossa. This had enlarged rapidly and had grown painful. I first lanced the area, which permitted about an ounce of pus to drain away. She was then given twenty minutes of visible light and one-half minute of actinic rays from the water-cooled lamp. Seven daily treatments were sufficient to heal the abscess. There was very little drainage after the third treatment.

DIAGNOSIS: Ischiorectal Abscess.

Case No. 426. Female, age 21. Was referred to us September 20, 1925, and gave the following history: had influenza followed by pneumonia in 1919, which was accompanied with abscess formation at hilus of both lungs (see roentgenogram, Plate No. XIX). Both abscesses broke into the bronchi into which they were still draining.

Since the inception of the trouble, she had been under constant medical supervision.

When she came to us, she was expectorating large quantities (sometimes a pint) of fetid muco-purulent secretions from both cavities. In general her health was failing, although there was no other pathology apparent.

We began treatment with the bath cabinet and actinic rays and one month later added diathermy. These treatments were given daily with steady improvement from the first week. The

cabinet treatments were from 10 to 20 minutes in duration, the extreme temperature being about 145° F., and were followed by actinic rays for 1 to 8 minutes.

The diathermy treatments were given through the hilus of the lungs. The applicators of composition metal—size 4x5 inches—were placed anteriorly and posteriorly. The milliamperage was about 1000, the time 30 to 45 minutes.

The improvement was gradual but persistent, as is best demonstrated by the second roentgenogram, Plate No. XX.

The quantity and odor of the expectoration steadily decreased.

DIAGNOSIS: Abscess of Lungs.

Case No. 494. Bone abscess of the tibia. (The reader is referred to bone abscess under the heading of Osteomyelitis.)

For stitch abscess, see report on page 148.

(See appendicitis.)

Acne.

Acne is an infection of the skin affecting particularly the face, neck, and upper parts of the thorax anterior and posterior.

It first appears as a small nodule, which later becomes a papule; still later, if allowed to progress, a pustule and from these various clinical manifestations come the various subtitles which only serve to confuse in what is otherwise a very simple disorder.

In some of the cases the nodules remain as such on the surface, but if punctured with tenotome will be found to contain pus in either the dermal or subdermal layer.

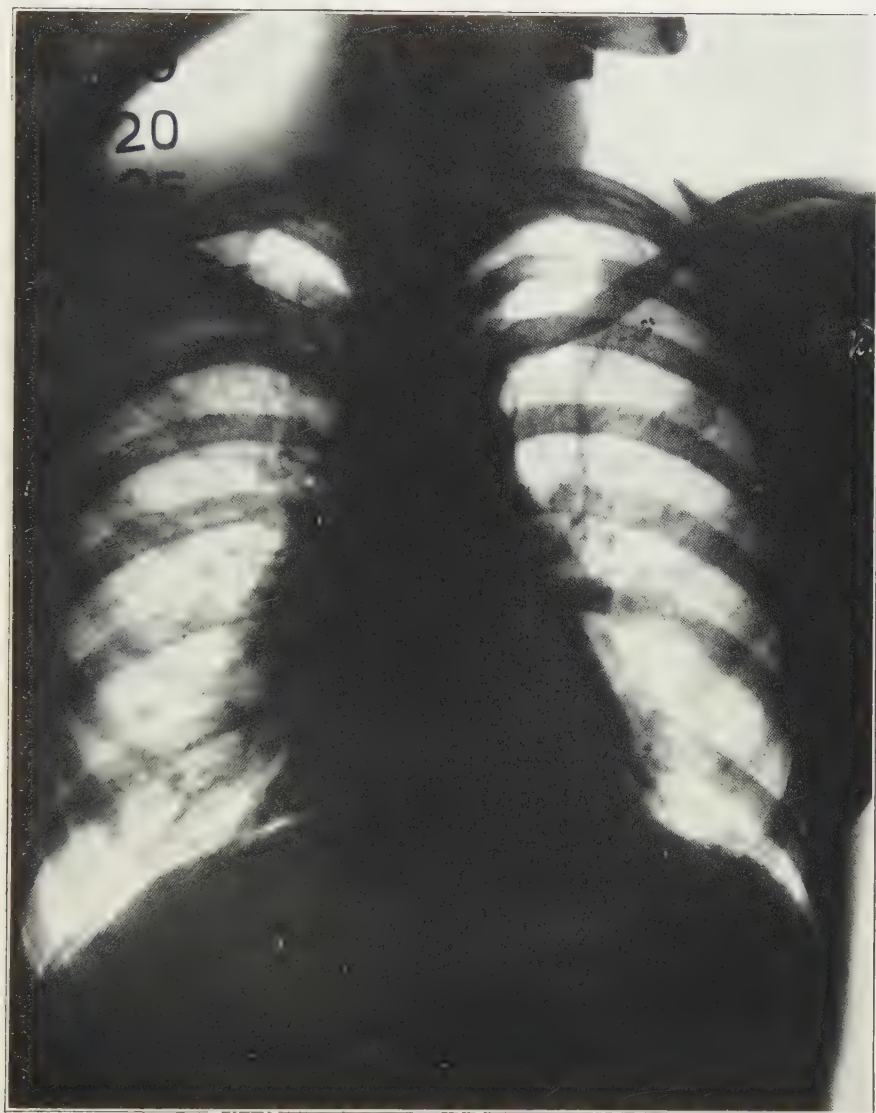
The etiology is a lowered skin resistance which may have a background in endocrinology, as most of these cases start at about puberty. However, no age is exempt.

Bacteriology. *Acne* bacilli are found in all cases followed according to number by staphylococcus albus and aureus, and occasionally other bacteria.

Pathology. The infection starts in the ducts of the sebaceous glands which have become occluded with sebum. If the duct becomes sealed, the gland becomes an abscess and scarring results, leaving a pitting similar in depth, but not in shape, to smallpox.

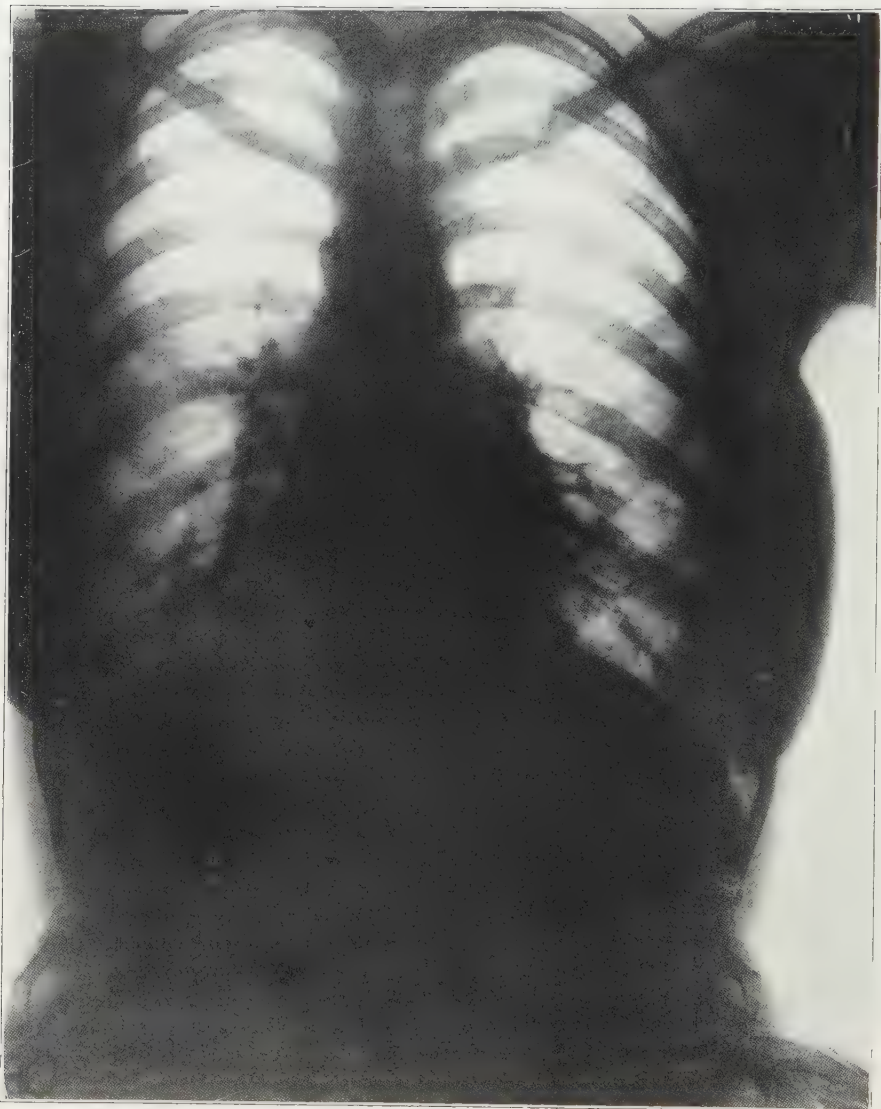
Symptoms are mainly objective, although at times there is soreness on pressure about the pustules. Treatment is sought for cosmetic reasons rather than for any physical disability.

The best treatment we have found is actinic-ray therapy. This is given as a general treatment, starting with ten minutes of the visible light and one minute of actinic rays over the chest and abdomen, front and back. The time is increased one minute each treatment until periods of ten minutes are reached and this period of time is continued. This general treatment is followed by just a few flashes from the water-cooled lamp, or just enough to produce a hyperemia, over the involved areas.



Abscesses in both lungs of six years' duration.

Plate XIX



Same case as Plate XIX after five months' treatment with visible light and actinic rays; with diathermy through lungs.

Plate XX

X-rays are at times of value in these cases, but must be used with caution in order to prevent a burn, which will be followed by fibrosis and scar tissue, which cannot be removed. This scarring takes the form of lineal fibrosis with contraction, a condition really worse than the acne. The pustules should be opened with a tenotome before giving the actinic-ray treatment. From ten to twenty treatments should be sufficient to clear up one of these cases, although it may be impossible to get the last small pustule or pimple.

Vaccines or bacterines occasionally are of value, but in the main are not to be relied upon to influence the course of the disease.

Case No. 109. Male, age 21. Had a pustular eruption covering all portions of his face for six years. His first actinic-ray treatment was given July 7, 1916, with the air-cooled lamp for four minutes, at a distance of twenty inches; other treatments on the 10th, 12th, 14th, 21st, 25th, 28th, August 1st, 7th, 14th, and 21st. We used the water-cooled lamp on September 11th, 18th, and 20th. Improvement began after the third treatment and continued uninterruptedly.

DIAGNOSIS: Acne Vulgaris.

Acne Rosacea.

Acne rosacea is a disease distinct from acne vulgaris. It appears mostly upon the nose and is characterized by general redness of the involved surface, which is usually the end of the nose, although the disease may spread over the ala to the cheeks. The erythema is usually intense and is with its location, the cardinal symptom. It may be anywhere in color from pink through red to an intense purple.

Pathology. Small white pustules may form in the diseased area. There is usually a general infection of the sebaceous ducts and glands which are so badly distended as to cause an enlargement of the nose.

Treatment. The sebaceous material must be removed by pressure before starting other treatment, which consists largely in the application of actinic rays from the water-cooled lamp to the point of blistering over the area involved. The treatments should be given two or three times a week at first, then less frequently and continued for weeks or months to prevent recurrence. A ten per cent solution of oleum terebinthinae in oleum olivae will aid materially in the recovery. It should be used locally twice daily.

Adenoma.

Adenomas are tumors of the secretory glands which may be encapsulated, thus forming polypoid growths. So long as they remain in their normal position and maintain their normal function they are benign. Once they break through their usual boundaries

they are then malignant and become carcinomas and not until this time do they break down or form abscesses.

Their most frequent site is in the mammary gland, thyroid gland, nose, larynx, testicles, prostate gland, stomach, bowel, bladder, and uterus. They are also found in the liver, the pancreas, and the spleen. When found in the kidney, they are known as a hypernephroma.

Their etiology is unknown.

Symptoms. The nearest we have to a cardinal symptom is a tumor growth in normal tissue, usually an enlarged gland structure. The most frequent subjective symptom is tenderness or discomfort which is increased by palpation, later followed by pressure symptoms and irritation.

Diagnosis. Adenomas, upon palpation, feel very much the same as normal tissue except there is an increase in the size of a portion of the normal organ. Pain appears only when the organ increases to a size sufficient to produce pressure upon surrounding structures.

The only positive diagnosis of adenoma is to remove a section for microscopic examination, otherwise it may be assumed if improvement takes place following actinic-ray treatments. Metastasis should be regarded as evidence of malignancy.

Treatment. These cases may be started with actinic rays from the water-cooled lamp provided that the case improves from the first treatment. Should improvement stop, further treatment with actinic rays is not advisable except as an adjuvant to radium or X-rays which should be used for their destructive action. If these fail, surgical removal should be advised. Electrocoagulation is not the method of choice in these cases unless they occur in cavities, thus giving complete drainage.

Adenomas yield readily to radium.

The length of time these cases require treatment will be from a few weeks to months or until they are entirely absorbed or removed.

Case No. 0116. Female, age 31. Her sister had had two operations on her breast, with return after each; tissue pronounced benign. The patient had had pain in the outer lower quadrant of the left breast for past eighteen months. There was at the time of examination a mass about 3x4 cm. in this location, which was sensitive to palpation. The patient was about four months pregnant.

Her actinic-ray treatments were as follows: July 17, 1918, she was given general visible-light and actinic-ray treatments and a local treatment over the mass with the water-cooled lamp for two minutes. There was relief of pain after the third treatment. Treatments were given at three day intervals until September 28th, at which time there was a small mass palpable, otherwise the breast was apparently normal and the pregnancy was progressing normally.

January 26, 1919, she was delivered of a healthy boy who nursed from both breasts. June, 1926, she is still in good condition with no return of the breast trouble.

DIAGNOSIS: Adenoma.

Adenitis.

Adenitis is an acute or chronic infection of the lymphatic glands. Acute adenitis is always associated with an acute infection and has for its etiology the absorption of the infecting organisms from these areas.

Chronic adenitis is usually tubercular, although it may be a lymphoid leukemia, a malignant lympho-sarcoma, a Hodgkin's disease, a Banti's disease, or syphilitic gumma. Any lymph gland in the body may be involved.

In syphilis we have an early adenitis which is acute and a late adenitis which is chronic. Both are usually non-suppurative. Suppuration may occur in either acute or chronic types.

The cardinal symptoms of an acute adenitis are the same as those of acute infections or abscesses which are swelling, redness, and pain while the cardinal symptom of any chronic adenitis is enlargement of the glands.

The etiology of an adenitis is the infection from which it springs and in tracing its source it is necessary to know the lymph distribution of the body.

The pathology of adenitis is that of inflammation. It occurs in the following order: infection, congestion, inflammation, hepatisation, suppuration, and destruction of the gland structure unless controlled by proper treatment at an early stage, then resolution will take place.

DIAGNOSIS: The diagnosis of adenitis is easy; the enlarged lymph node is all that needs to be found, but its differentiation as to etiology will at times tax the skill of the most expert and even then may be settled only by the microscope.

The prognosis of adenitis is usually favorable, but it may be unfavorable, depending upon its etiology.

The treatment of these cases consists of first destroying the source of infection, if this is at all possible. This is best accomplished, if not malignant, by the use of actinic rays from the water-cooled lamp. The air-cooled lamp can be used if the length of the treatment is increased about three times. Distance from the water-cooled lamp should be one-half to one inch and about two inches from the hood of the air-cooled lamp. The length of time for the treatment with the water-cooled lamp should be from one-half to three minutes, with the air-cooled lamp from two to ten minutes. These treatments should be given daily at first and as the case improves should be given on alternate days. General visible-light and actinic-ray treatments should always accompany the local treatments.

In addition to treating the source of infection, the involved gland area should also be rayed. Not only the gland but an area of three or four inches of normal tissues surrounding the gland should be treated. If suppuration has not already occurred, this will usually destroy the infection and restore the gland to normal without operative interference. If, however, suppuration has occurred, the gland must be lanced with only sufficient opening to permit the drainage of a portion of the necrotic material, as was advised under the heading Abscess.

We do not sanction curettage and irrigation, as we believe that more damage than good is done with this procedure.

Internal medication is of value. Intravenous medication with sodium iodide and guaiacol is indicated. In tubercular cases, calcium and iodine are of value and can be given in the form of iodide of lime, one grain one to three times daily, or as tincture of iodine, giving from one to ten drops in a glass of milk on an empty stomach three times a day. Calcium phosphate can be used by mouth in doses of five grains once a day or calcium cacodylate, one grain of which may be given intravenously every second day. All of these, when used in conjunction with actinic rays, are of decided value.

General supportive treatments in the form of diet, fresh air, and sunshine are of distinct value in all cases of adenitis and should be used in conjunction with the other treatment advised.

Rest in bed is not necessary for adenitis alone, but the primary source of infection may be of sufficient magnitude to make the patient bedfast. The above treatments are particularly indicated for bedfast patients.

The length of time these cases will require treatment is from a half dozen treatments for acute infections to months for tubercular cases. Syphilitic adenitis requires specific treatment, while lymphosarcoma will require radium or X-ray. See index for Hodgkin's disease.

The prognosis is good in simple adenitis; poor in malignant adenitis.

Case No. 651. Male, age 30. Was referred to us for treatment on November 29, 1924, for enlarged glands in the right cervical region, which he had had for nearly two years. Had been operated in July and again in October, 1924. One sinus was draining.

His first treatment consisted of visible-light and actinic rays, followed by a one-minute local application of actinic rays from the water-cooled lamp at a distance of one inch. The following day the sinus had stopped draining and the actinic-ray treatments were increased to two minutes. Daily treatments were given for one month. The treatments from the air-cooled lamp were gradually increased to seven minutes and the local treatments with the

water-cooled lamp kept at two minutes. In February he had eight treatments, although there were no signs of recurrence and the integument about the fistula was movable over the underlying sinus scar and tissue.

DIAGNOSIS: Tubercular Adenitis.

Case No. 219. Female, age 43. Came for treatment September 26, 1923. She had noticed a number of movable tumors in the right cervical region 1½ years ago and was operated in June, 1922, for their removal. The same region was reoperated in February, 1923, followed by a return in June, 1923. At the time of my first examination there were several movable tumors in the right cervical and right supraclavicular regions, but none were adherent to the skin.

Her treatments were general visible light and actinic rays and local treatments of the involved area with the rays from the water-cooled quartz lamp. The general treatments were from 1 to 10 minutes, while the local treatments were either 1 or 2 minutes each. There was steady improvement for about three months, then a quiescent period. At this time we used radium packs of 50mg. each over this area for 1½ hours, continuing the actinic-ray treatments as before with a resumption of the improvement.

DIAGNOSIS: Tubercular Adenitis.

Adhesions.

Adhesions arise from two causes, traumatism and infection, which cause a proliferation of lymph into the tissues or cavities, which finally become vascularized and then cicatrized.

Neoplastic fibrosis about the joints may take on calcareous deposits. In the abdomen, proliferated lymph forms velamentous bands which by contraction and neoplastic fibrosis may form heavy adhesions.

The diagnosis of adhesions about the various joints and muscles is comparatively easy because of the lack of motion while adhesions within the peritoneal cavity are, at times, difficult to diagnose, but usually they can be located by a roentgenographic examination, both fluoroscopic and plate, without the necessity of opening the abdomen, although at times the latter procedure is necessary.

Adhesions are essential to the repair of inflammatory processes due to sepsis or in the repair of fractures, dislocations, strains, or a solution of continuity of muscles, or ligamentous tissue. Following this repair, it is essential that the joint is not left in one position for any great length of time without having passive motion performed.

The traumatic cases are either fractures or dislocations in or near joints or repeated small injuries on or about the joints, which finally produce congestion and inflammation. In joints, adhesions

frequently occur after long immobilization for fractures and even in joints which are remote from the fracture. These conditions are among the most common that physiotherapists have to treat.

Among the infectious bacteria which produce inflammation and adhesions of joint surfaces, serous membrane, etc., are staphylococci, streptococci (various species), then gonococci, tubercular bacilli, occasionally pneumococci or colon bacilli.

The peritoneum itself is a frequent site of adhesions due to infection of the various organs in the abdomen. For the peritoneal cases where there is severe infection, it is necessary to allow adhesions to form for protection, but as soon as drainage is established or as soon as the infection is over, the use of cathartics or measures which are stimulative of peristaltic motion are of decided value in limiting the amount of adhesions. After they have formed and after the repair process is completely established, diathermy is invaluable in breaking up these adhesions, particularly those of velamentous type, and later of the lighter fibrous bands, although less valuable for the heavy fibrous bands.

The pleura, likewise, is a common site of infection and of adhesions. The location or the amount of adhesions present will determine the mode of application of physical therapy. The etiological factor in the production of the adhesions must be known, and if this etiological factor has not been removed, treatment will be of little or no value in the removal of the adhesions. On the other hand, it must be remembered that the treatment of the etiological factor may be sufficient to relieve the adhesions present, for nature tends to absorb them if they are not too old or too fibrous, and if calcareous deposits have not taken place. Thus, many times, two things can be accomplished with one treatment. However, in these cases the treatment must be directed towards the etiological factor and not toward the adhesions which are of secondary consideration.

After the etiological factor has been removed, the adhesions may be treated as such and physical therapy offers much for these cases. Visible light and actinic rays are beneficial and should be used as general treatments, except where the condition is confined to a small area, then local treatments will be sufficient. Following the visible-light and actinic-ray treatments, diathermy, using the d'Arsonval current, will be found very beneficial in breaking up the adhesions themselves. Diathermy is less valuable where there is heavy fibrous tissue. Adhesions of long standing, say ten or even twenty years, may, many times, be benefited by diathermy, followed by the slow sinusoidal current or combined slow and rapid sinusoidal currents to aid the contraction of muscles and to restore circulation. Visible light is of benefit in relieving pain, swelling, and edema.

The actinic rays should be used for a period of one to ten minutes, depending upon the case. It is seldom necessary to exceed this limit while the visible-light treatments should be from ten minutes to one hour or more and should precede the actinic-ray treatments. In other words, the visible-light treatment should be continued long enough to relieve the congestion, and lymph and blood stasis, thus bringing new blood into the tissues.

Diathermy treatments should be given through and through the areas involved. The ingenuity of the operator will be taxed many times to find the best location for the application of the electrodes as well as some means of maintaining them in position during the treatment. Pillows, sand bags, elastic roller bandages, etc., may have to be used to hold the applicators in place. The applicators should be as large as the involved area will permit and must be maintained in absolute contact with the skin or mucous membrane. In the knee joint, for example, it may be necessary at one time to drive the current through laterally, and at other times anteroposteriorly. These are the questions that the operator must decide for himself in each individual case, always remembering that if the tissues near the surface are to be heated, the applicator over that area must be smaller than the one on the opposite side. If the applicators are of equal size, the most intense heat will be at a point midway between the two.

The best applicators are made of composition metal, thin enough to fold readily over the joint, and molded to fit each individual case. There is no need of lathering these applicators and seldom any need of wetting them. The current should be turned on slowly and increased for about five minutes to the maximum heat required and maintained at this temperature from fifteen to thirty minutes, then turned off slowly, taking a minute or more. This will avoid shocking and frightening the patient.

The maximum current to be used will usually be about fifty milliamperes for each square inch of the smallest electrode used, although this may, in individual cases, be run up to two or three times this amount.

Extreme care should be taken to avoid even the slightest burn, and this can be accomplished only by keeping the applicators in absolute contact with the skin.

These treatments should be repeated daily until there is definite improvement, then two or three times a week, and continued indefinitely as long as the case improves. If no improvement takes place after five or more treatments, it may be assumed that the treatment is either not indicated or has been improperly given.

Where muscles are adherent, as after a long application of casts, the slow sinusoidal current will be valuable along with massage and visible light in releasing these muscles. The technique

here is to use the visible light for twenty or thirty minutes at a distance comfortable to the patient, meanwhile massaging the muscles involved for about five minutes, then applying the slow sine current one pole over the spinal origin of the nerves supplying the part involved, the other pole over various portions of the adherent muscle or muscles, paying particular attention to the point of exit of the nerve supply. This current should be very light at first, gradually increasing it from treatment to treatment, to as much as the individual will stand without discomfort, which is usually somewhere from thirty to forty milliamperes. It should not be continued for more than ten minutes and at a rate varying from ten to thirty contractions per minute. This permits a small rest period between each contraction and avoids over-fatiguing of the muscles. These treatments should be given daily until there is decided improvement, then two or three times a week.

In a few of these cases, galvanism will be of definite advantage, and it is best given in the form of interrupted or surging galvanism, which produces a very decided shock to the muscles and nervous system. This current should be increased and decreased very gradually to avoid causing pain. As in all electrical treatments, no treatment should be given which causes pain to the individual, because it is not productive of benefit and it will deter the patient from taking a much needed method of therapy.

Adhesions—Peritoneal.

Case No. 93. Female, age 41. Came for treatment August, 1923. Three years previous to this date the patient had an appendectomy, after which there was continual discomfort in the region of the caecum. This discomfort had increased during the following year and roentgenograms of the intestinal tract taken at the National Laboratories, Chicago, showed numerous adhesions in the right, lower abdominal cavity.

Diathermy was given. A six by eight composition-metal electrode was used posteriorly opposite the caecum and a four by six composition-metal electrode anteriorly over the caecum. The milliamperage was 700 to 1000 for thirty minutes. The treatments were given three times a week. Eighteen treatments were given with complete relief.

For joint adhesions, see Case A545, Page 140 (see Ankylosis).

Alopecia.

By *alopecia* we mean baldness either local or general. The name is qualified in various ways, either as to etiology, pathology, or region involved.

As far as treatment is concerned, we are interested only in one thing: Is there or is there not a hair follicle or matrix with

which to grow new hair upon the area involved and it makes no difference whether this is a bald spot or the entire scalp including the eye brows.

A protracted fever will cause a baldness of the entire head, leaving, many times, fairly nutritious matrices, which if stimulated will immediately produce a fairly good head of hair. If baldness is due to furfuraceous or sycotic infections and if the roots or matrices are not destroyed, the destruction of the fungus on the surface is sufficient for an immediate restoration of hair. This is most frequently the etiological factor of alopecia areata. When alopecia is due to a nutritional disturbance, it can, likewise, be restored. The growth of hair can also be restored by increasing the general nutrition of the body without paying much attention to the scalp itself, although with the general treatment, local treatments should be given.

For senile alopecia, due to other than the causes already mentioned, little can be done in the way of restoration.

Syphilitic alopecia will be restored to a large extent by treating the etiology syphilis, although there is never a full restoration of the hair.

The various oils have but little if any beneficial action, neither have the irritant mixtures. Olive oil and cod-liver oil are exceptions to this rule, but the latter is of such penetrating odor that few will use it. On the other hand, antiseptics of the resorcin or sulphur type are at times of value. Massage is of exceeding value in the restoration of the nutritional type, but of no value in the sycotic or furfuraceous type.

The nutritional types can all be benefited by the use of actinic rays both for general treatments to improve the condition of the body and for local treatment to the scalp to improve local nutrition and to stimulate the hair follicles to renewed energy.

General treatments should be given with the air-cooled quartz mercury-vapor lamp, preceded by the visible-light as given under the head of General Treatments.

Local treatments should be given with the water-cooled lamp to the point of blistering, which will take one or more minutes for each area. If possible, remove the hair, either by shaving or close clipping, before starting the treatments. For all treatments of the scalp, the air-cooled lamp may be used if the water-cooled is not at hand. Cleanliness should be insisted upon.

The length of time these cases will require treatment will be from a few treatments to several months.

Case No. 123B. Female, age 44. Had laparotomy performed in June, 1916. Soon after, she began to lose her hair. She began actinic-ray treatments on October 2, 1916, when she was given a seven-minute treatment at a distance of two inches (water-cooled

lamp). This was repeated thrice weekly for five months, working up to forty-five minutes for the entire scalp, which resulted in a splendid growth of black hair, although the lost hair was decidedly gray.

DIAGNOSIS: Alopecia.

Amenorrhea.

Amenorrhea, the absence of menstruation, is not a disease but a symptom of various diseases. It is physiological before puberty, after the menopause and during pregnancy. It is a pathological condition during the course of a surgical infection or hypothyroidism, at which time there is apparently an effort on the part of nature to preserve the vital energy of the individual. This is particularly true during the active progress of a pulmonary tuberculosis. Most of these cases, however, recover without any special treatment being directed toward the relief of the amenorrhea, but rather toward the etiological factor causing it.

The amenorrhea with which we now deal effectively is that occurring during the course of a hypothyroidism. These cases may occur at any age, but are usually between the ages of fifteen and twenty-five and in girls who are obese. It may be either partial or complete. It may occur for a single month or for consecutive months over a period of several years. While it does not damage the general health, except in permitting an over-production of fat, it is rather disturbing mentally to the patient and her family.

Hypothyroidism produces a low mentality.

There may or may not be an enlarged thyroid gland. If enlarged, it is usually a simple parenchymatous hypertrophy, with no definite pathological change. The enlargement is apparently due to an effort of nature to increase the endocrin function.

Differential diagnosis of these cases will be between hypothyroidism and general debilitating diseases as infective fevers, influenza, etc.

The general management will be plenty of outdoor exercise and a light fruit and vegetable diet, excluding the heavy starches.

The therapeutic measures are usually the feeding of thyroid by mouth in doses from one-tenth of a grain to one grain three times a day.

Corpus luteum one cc. intravenously is of decided benefit in cases of ovarian hypofunction. This amount should be given from daily to thrice weekly. Be sure the corpus luteum used is prepared for intravenous use. Some of it is not.

The physical therapeutic treatment of these cases is vibration of the second and third dorsal vertebrae for about three minutes, three times a week. Concussion may replace the vibration. Until menstruation has been well established, it would be well to use thyroid in addition to the physical-therapeutic treatment. After

menstruation has been established, the thyroid may be discontinued but the vibration or concussion should be continued over a period of several months.

The prognosis is good.

Case No. 001. Female, age 22. General health excellent. Came to us in May, 1920, with the single complaint that she had not menstruated for over two years. No apparent cause for the amenorrhea, as she had menstruated previously.

Examination of the pelvis showed the sex organs to be normal in size. Physical examination was negative except for an enlargement of the thyroid gland. Her weight was 160 pounds, height five feet and seven inches, so that while she was obese she was not excessively so.

The diagnosis was hypothyroidism.

Her treatment consisted of vibration of the second and third dorsal vertebrae for a period of five minutes three times a week. At the end of the third week, menstruation returned, although the flow was scant.

The treatments were then continued twice a week for two months. After three consecutive periods, treatments were discontinued.

Anemia.

Anemias are classed as primary and secondary or acute and chronic.

The primary anemia is the primary progressive pernicious anemia with its progressive destruction of the red cells and its decreased count of the white cells.

Primary pernicious anemia is undoubtedly a systemic rather than a blood disorder and is probably due to an infection or a toxin from an infection somewhere in the body with a definite increase in the histocytes. Definite proof of this has not, as yet, been established but clinical symptoms point to it as a fact. Influenza is a frequent prodrome, as are many focal infections. *Bacillus welchii* and *coli* have been found in almost pure culture in many cases of classical pernicious anemia and may be looked upon as an active etiological factor in view of their ability to develop a potent hemolysin, acids, and toxic substances.

Pernicious anemia is definitely progressive and is usually fatal in from two to three years after diagnosis, although one case has been reported that lived fourteen years after diagnosis.

The blood count is as follows: the red cells are markedly reduced although they contain an excess of hemoglobin giving a color index much above normal. There are poikilocytes and anisocytes which with the high color index are diagnostic. Nucleated reds and megaloblasts are abundant and also diagnostic though they do occur in secondary anemias. The total number of red cells may be

below 1,000,000. The leucocytes are decreased as low as 1500 per cm. The lymphocytes are increased to as much as 60%. The polymorphonuclear neutrophils show a corresponding decrease. Myelocytes and myeloblasts are sometimes found. Thrombopenia is fairly common.

The systems are affected in about the following order, the digestive system, the blood stream, the nervous system, and the circulatory system.

The digestive symptoms first described are usually anorexia accompanied by diarrhea both of which have periods of remission. Achylia and achlorhydria usually precede and accompany these conditions. Nausea and vomiting are frequent and there is a decided reduction of endurance which progresses with the disease. There is a loss of flesh in most cases though occasionally a case remains obese to the end at which time some of the obese appearance may be due to edema.

The blood derangement has already been given.

The first nervous symptoms are an irritability with extreme nervousness accompanied by paresthesia, hyperesthesia, and pain particularly in the legs.

The mind is usually alert even in the late stages though at this time mental torpor may appear and is the accompaniment of severe anemia. In the last stage the patient is more or less paralyzed or at least bedridden. This condition lasts from one to three months.

The skin in fairly well-advanced cases is a sallow lemon color. Late in the disease, the spleen and liver are both enlarged.

The circulatory symptoms start with dyspnea followed by hemic murmurs, low blood pressure, and a rapid pulse. A chronic myocarditis may accompany or be associated with a dilating cardia. Air hunger, insomnia, edema, and ascites are all late symptoms.

Pernicious anemia must be differentiated from bothrioccephalus anemia which simulates it closely. Other diseases with which it must be differentiated are profound secondary anemias, late gastric carcinoma, Hodgkin's disease, splenic anemia, the leukemias, and late syphilis.

As already stated primary pernicious anemia has, as yet, an unknown etiology but it is probably a chronic infection.

The prognosis of true pernicious anemia is exceedingly grave as most cases are not diagnosed early enough to permit effective treatment. In prognosing a given case, the fact must be remembered that pernicious anemia has periods of improvement and relapse if no treatment is given, and this must be considered when improvement takes place under any system of treatment. For weeks and even months the patient seems to be growing better only to have a relapse.

The disease occurs mostly in middle-aged people.

The average length of life of these cases is from six months to two years, after it is possible to diagnose the condition. Sajous (page 639 Vol. 1) gives the following as favorable symptoms, "The red cells, although much diminished, have a tendency to rise. The megaloblasts are atypical and not numerous. The normoblasts are numerous. The color index is high and tends to fall; polychromatophilia are not marked. Polymorphonuclears are high and the myelocytes are absent or scanty."

Unfavorable symptoms are hemorrhage from any portion of the body during the course of the disease. When the red cells are below one million, the megaloblasts are typical and numerous and the normoblasts are more numerous than the megaloblasts. The color index remains high after the fever and the myelocytes are numerous. Macrocytes are indicative of a grave anemia.

A primary anemia other than progressive pernicious can be of one origin only and that is a very active hemorrhage from any part of the body although chlorosis is usually classed as a primary anemia.

The characteristic blood picture of chlorosis is a large reduction of the hemoglobin with very little variation in the red count giving a low color index, the very opposite of pernicious anemia. Thrombin is normal, again contrasting the condition with pernicious anemia which has a thrombopenia. Again chlorosis is a disease of young girls while pernicious anemia is usually found in middle life and in both sexes.

The severity and the symptoms of an acute primary anemia will depend entirely upon the amount of blood lost. This may be a quantity sufficient to destroy life in a few minutes or it may be sufficient to prevent the blood making organs from regenerating the proper number of cells to maintain life, thus destroying it in a few weeks or months.

All other anemias are secondary conditions, due largely to the infections, intoxications, or small repeated hemorrhages continuing over a long period of time or at varying intervals. These are secondary to malignancies, chronic nephritis, dysentery, cirrhosis of the liver, malaria, intestinal parasites, etc.

The blood picture in the secondary anemias varies greatly and depends upon the etiology. The hemoglobin is around 50%, while the red cells will be from 2 to 3 million, possibly lower. Achromia is a most important diagnostic point. But if there is a chronic infectious process, there will be an increase in the leucocyte count, especially of polymorphonuclears. In general, with anemias the higher the leucocyte count the better the prognosis. The opposite is true of leukemias. Objective symptoms should not be depended upon in the diagnosis of anemias.

While pallor, dyspnea, and edema are cardinal objective symptoms of anemia, they are not to be relied upon for any length of

time unless one absolutely cannot obtain a complete blood analysis. In many apparent cases of anemia the blood count and the hemoglobin percentage will be found to be normal or nearly so, therefore the blood count alone is to be relied upon for making the diagnosis.

Pallor, dyspnea, and edema become more marked as the anemia progresses. This holds true also of *primary pernicious anemia*. The edema is always most pronounced in the lower portion of the body and as the anemia improves each symptom improves in the reverse order of its appearance; therefore, the treatment should be directed towards the etiology if it is possible to find it.

Treatment. It would be unwise to expect treatment directed towards the symptoms to have any definite action upon the blood picture. Notwithstanding this it is, at times, advisable even in incurable cases to stimulate the blood producing organs. At this time calcium cacodylate in doses of one grain intravenously seems to be the best preparation to use, followed by general visible-light and actinic-ray treatment. Outdoor life, with its fresh air and sunlight, plus a diet rich in mineral elements are factors invaluable in the restoration of the blood stream.

"Human blood withdrawn under strict aseptic conditions may be injected subcutaneously in doses up to several ounces with at least temporary improvement. The toxicity which comes when blood is given intravenously is not seen when it is given subcutaneously. (Jour. Lancet, Minneapolis, 12/15/16 XXXVI No. 24.)"

Hydrotherapy and massage aid in improving the circulation which in turn helps each and every tissue of the body. In addition to the outdoor life with its limited amount of actinic rays, we have available today an artificial sunlight in the form of actinic rays from a quartz mercury-vapor lamp. The application of these rays to the patient is not only beneficial to the anemias but helps to eradicate the etiological factor in the case. These treatments should be given with the visible light for at least ten minutes over the body, front and back, to be followed by the air-cooled quartz mercury-vapor lamp, starting at one-half to one minute and increasing one minute daily until ten minute treatments are reached.

Another physical measure of value is the use of diathermy. This should be used through the spleen one day and through the liver on the alternate day. The applicators should be of composition metal (22 B&S gauge) of a size to fit the patient but covering a considerable area of either organ, usually about four by five inches. The amount of current used should be from 500 to 1000 milliamperes for twenty to forty-five minutes. The average time of treatment should be about thirty minutes. This should be used daily for two or three weeks, then discontinued for a week, after which its use may be repeated. There are no contraindications to

using diathermy and ultra-violet frequencies at the same time. Do not use iron in pernicious anemia, for the color index is always high, over 1+. Stieglitz has found an excess of iron in the kidneys and thinks it a factor in producing the nephritis which accompanies pernicious anemia. He also found an excess of iron in the spleen and liver.

For the infective processes, it is well to use sodium iodide, 32 grains, and guaiacol, $\frac{3}{4}$ of a grain, intravenously, alternating this at times with a solution of iron cacodylate, $\frac{1}{2}$ grain; sodium cacodylate, 2 grains, and nuclein solution, 16 m., which is also given intravenously. Stomachic tonics aid the appetite and of these gentian, hydrastis, nux vomica, or alfalfa are among the best. If there is even a suspicion that the case may have had a previous malarial infection, it is well to give quinine cacodylate, $7\frac{1}{2}$ grains; iron cacodylate $\frac{3}{4}$ of a grain and calcium cacodylate $\frac{3}{4}$ of a grain (Kersch), intravenously, and this preparation may be alternated with the sodium iodide and guaiacol solution.

Blood transfusions may be used to tide the patient over a critical period, but are in no sense curative or restorative of blood-making tissues.

For the local or focal infection, use the rays from the water-cooled quartz mercury-vapor lamp over the infected area. If there is an accompanying colitis, it is best to use a five to twenty per cent solution of the fluid extract of krameria in warm water. Inject this into the bowel daily through the ordinary rectal tube introduced several inches up the bowel while the patient is in the knee-chest position.

The diet should be mainly of fresh fruits and vegetables, either cooked or uncooked. If cooked, the water in which they were boiled should be saved for soup stock, thus preserving the valuable mineral elements to be found therein and which are vital to the relief of these cases.

Secondary Anemia.

All anemias, except primary progressive pernicious, chlorosis, and simple primary are secondary, and when properly classified the above exceptions, except simple primary, will undoubtedly be found to be secondary. Webster classifies all cases of undetermined etiology as primary and the cases in which it is possible to determine the etiology as secondary. Cabot classifies the secondary anemias as mild, moderate, severe, and very severe. The very severe resembles primary pernicious anemia so closely that a definite differentiation may be impossible.

The average blood picture of a secondary anemia will show a marked decrease in the hemoglobin with a subnormal color index. The color index is lowest in the serious chronic diseases, as the late stage of cancer, gangrene, and long continued pyogenesis.

The erythrocytes are greatly reduced, particularly in late stages, at which time the poikilocytes appear along with anisocytes. If nucleated reds appear they are usually normoblasts. While the leucocyte count varies, it is nearly always increased, particularly the polymorphonuclear neutrophils. The blood platelets are increased from once to twice their normal number of 250,000 and thus become a differential diagnostic point, for in pernicious anemia they are always diminished.

Regeneration of blood cells is most rapid in men and between the second and fifth decades. Where there is no constitutional disease, the regeneration requires from ten to thirty days. The hemoglobin deficiency requires more time for its return to normal, and during this time the newly formed blood cells are easily destroyed.

The most common etiological factors in the production of secondary anemias are chronic infections or intoxications, low grade fevers, and small frequently repeated hemorrhages or anything which lowers the general vitality. The above are associated with apical abscesses, tonsil infections, chronic ulcers, chronic cholecystitis or appendicitis, intestinal parasites and various chemicals of which lead is a type. Small frequently repeated hemorrhages are associated with uterine fibroids, ulcers of the alimentary tract, dysentery, hemorrhoids, and carcinomas.

Among the cardinal objective symptoms are pallor, dyspnea and edema; however, these are not to be relied upon unless it is absolutely impossible to obtain a complete blood analysis. In many cases of apparent anemia the blood count and the hemoglobin percentage will be found to be normal or nearly normal.

An accurate diagnosis must be based upon an accurate differential count. Pallor, dyspnea, and edema become more pronounced as the anemia progresses. This applies also to primary pernicious anemia, in which the pallor becomes a greyish-yellow as the anemia progresses. The dyspnea is first noticed when a little extra exertion is required, later it is pronounced upon the slightest muscular activity. The edema manifests itself in the most dependent portion of the body. All symptoms improve in the reverse order of their appearance. If they are progressive in spite of treatment, they mean a fatal prognosis.

Many of the symptoms are correctly attributed to the primary etiological factor and not to the anemia which in itself is a symptom. When the anemia is pronounced, menstruation may be diminished or there may be amenorrhea. This is a wise provision of nature to prevent further loss of blood. If the anemia disappears within the range of the menstrual life, the flow will be restored.

X-ray and radium both produce a secondary anemia which is characterized first by a marked leukopenia with early destruction of the polymorphonuclears, and late destruction of the small lymphocytes.

The prognosis of a secondary anemia depends mostly upon the primary etiological factor. If this is a simple infection, the anemia will gradually disappear following its removal; therefore the treatment should be directed toward the etiology if it can be discovered. Do not expect treatment of symptoms to remove definite pathology. At times it may be wise to treat the symptom anemia in incurable cases for the comfort it will give the patient, but do not delude yourself that this improvement tends toward recovery. The removal of the etiological pathology is of primal importance, after which treatment that will aid in the restoration of the blood stream will be indicated.

The treatment of the various etiological factors will be found under their various headings.

Physiotherapy plays a very definite part in the treatment of secondary anemias. General treatment with visible light and actinic rays is indicated in nearly every case. Remember that the visible-light frequencies are used primarily to relieve the lymph and blood stasis and to bring the blood to the surface, where it can absorb the actinic rays, as they do not penetrate the tissues deeply. Also remember that their action is chemical, producing chemical changes in the blood stream and body tissues and in the sterols which are to be found in the skin and therefore readily reached by the ultra-violet light. The sterols are absorbed after activation.

Calcium should be given along with phototherapy in these cases and at times it seems wise to add ferrum phos. in doses of 1/100 of a grain three times daily. Any one of the several forms of calcium may be used. Personally we prefer the calcium cacodylate in doses of one grain intravenously once daily. Calcium lactate or phosphate in five grain doses daily may be given per oreum. Strychnin phosphate in doses of 1/100 of a grain t.i.d. aids in toning up the nervous system and if one wishes to combine a stomachic add hydrastis mur. 1/100 of a grain to each dose.

If an infective process accompanies or has preceded the anemia, sodium iodide and guaiacol in doses of 32 grains of the former and $\frac{3}{4}$ of a grain of the latter will aid in its destruction and thus remove the etiological factor and indirectly improve the anemia. At times this may be substituted for an iron and sodium-cacodylate and nuclein solution in doses of one-half grain of iron, two grains of sodium and sixteen minims of nuclein. This should be given intravenously from daily to twice weekly.

Hydrotherapy and massage aid in improving the circulation, which in turn helps each and every tissue in the body. An outdoor life should be insisted upon as much as possible.

The diet should be mainly fruits and vegetables, a liberal supply of which should be uncooked. Milk is an important article of diet in these cases and may be combined with the fruits as follows: Take $\frac{1}{4}$ glass of cream, $\frac{1}{4}$ glass of milk. Chill thoroughly. Mix

the juice of one orange, the juice of $\frac{1}{2}$ a lemon and a teaspoonful of strained honey and chill. Slowly pour the fruit juices into the cream and milk and stir rapidly. This will make a fine curd and a finer drink (Kersch). The mixture should be eaten with a teaspoon. Three of these a day may be used if the stomach can digest that quantity of cream. Pineapple and the various fruit juices should be given liberally. The water in which vegetables are boiled should be saved for soup stock, thus preserving the valuable mineral elements to be found therein and which are vital to the recovery of these cases.

For the focal infections accompanying anemias, use the water-cooled actinic-ray lamp, throwing the rays over the involved area for one-half to one minute, following the general light treatment.

See case report under Fibromata, page 235.

Ankylosis.

Ankylosis may be either partial or complete, depending upon whether it is a fibrous or an osseous ankylosis.

The etiology may be trauma or an infecting organism in or about the joints capable of producing inflammations which in turn cause an outpouring of lymph, blood, and plasma. These accumulations contain a large amount of fibrinogen, which is necessary for the production of fibrous tissue, which in turn may become the site of a deposit of osseous cells, in which case there will be complete and permanent ankylosis.

The pathology may be either a simple synovitis or infective arthritis, or there may be destruction of the joint surfaces due to erosion or trauma. These conditions are all benign.

The blood picture will be that of a simple infection which is as follows: marked leukocytosis with a percentage of 80 or more polymorphonuclears.

If the case is seen early or when the infection is at its height, it will be necessary to use rest and immobilization, which does not need to be by traction or splints. In these cases cleanliness inside and out must be insisted upon and exercise, either passive or active, of the part reduced to a minimum.

Of the therapeutic methods used, internal medication is of comparatively little value, while sodium iodide and guaiacol intravenously are of immense value and magnesium sulphate as a wet dressing, using one ounce to a pint of water, will aid in limiting the outpouring of lymph and in absorbing the present accumulation if it is not infected.

The use of visible light and actinic rays, both for general and for local treatments, over the site of the lesion is of untold value. The visible light should be used from thirty minutes to several hours daily at a distance comfortable to the patient.

After ankylosis has become established and if it is fibrous, the use of diathermy given through the joint to the point of tolerance will help absorb the fibrous deposits and restore the joint to at least partial function. If, however, there is an osseous ankylosis, little can be done by any physiotherapeutic modality and the case is one for arthroplasty alone.

The length of time required to treat a case of fibrous ankylosis will vary from a few weeks to a few months. Treatments should be given daily until there is decided improvement, then twice or thrice weekly.

The size of the electrode used in these cases will depend upon the size of the joint but should not be large enough to permit the edges of the electrodes to come closer to each other than the distance through the joint, otherwise there would be a short circuiting with its accompanying pain and possible tissue destruction.

The amount of d'Arsonval current necessary to treat these cases will vary from fifty to one hundred milliamperes for each square inch of the smallest electrode.

Massage and passive motion should be used as soon as it is possible to use them without causing pain.

Case No. A545. Female, age 32. January 20, 1925. One year previous she had slipped on the ice and received a compound comminuted fracture of the left tibia, lower third. The fragments united but left the ankle nearly immobile with severe pain on attempted motion. Considerable swelling remained about the ankle.

Her treatments consisted of 700 milliamperes of diathermy for thirty minutes daily. One day the composition-metal electrodes were placed anteroposteriorly, on the alternate days laterally. They were of equal size, about two by three inches. The first treatment gave some relief of pain and some increase of motion.

Ten treatments, taken twice weekly, improved the motion so that she could go up and down stairs without dragging the injured foot to the level of the uninjured one. The swelling was somewhat reduced and she was free from pain.

DIAGNOSIS: Ankylosis the result of Comminuted Fracture.

Appendicitis.

Appendicitis is not a disease which lends itself readily to physiotherapeutic methods and should be considered surgical from the first, but in a case of appendicitis with pus formation and after surgical drainage, physiotherapeutic measures are invaluable.

Beginning within twenty-four hours after the establishment of drainage, it is well to give intravenous injections of sodium iodide and guaiacol and then use visible light from one hour to the full twenty-four hours, according to the indications. This should be followed by actinic rays beginning with one minute over the chest

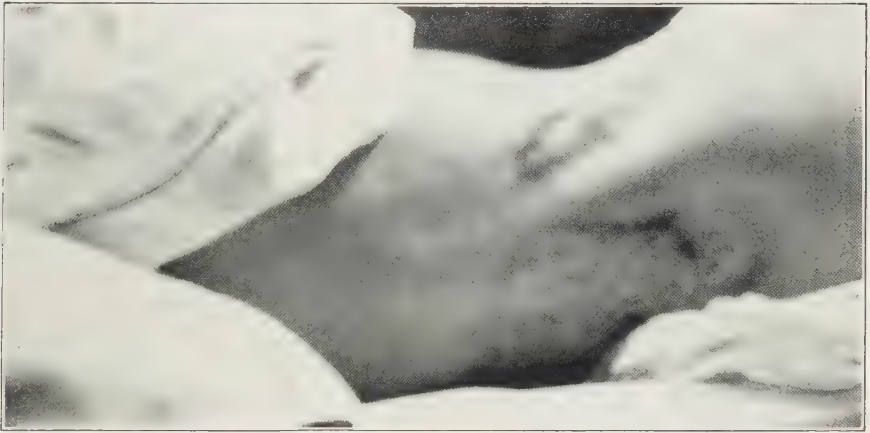
and abdomen as well as over the site of the drainage, for their full therapeutic effect upon the blood stream where they will be found to increase the red blood cells and increase or decrease the white cells according to the physiological needs of the body. Actinic-ray treatments should be increased one minute a day until a period of ten minutes is reached, which is the maximum period of time given. With this treatment it will be found that cases with drainage will heal about as quickly as the cases which do not need drainage and will leave the hospital in about the same length of time.

If there are adhesions following drainage, diathermy given with one electrode over the lumbar region, the other over the region of the former appendix with just enough heat to be comfortable will give relief of pain. This relief is due to the absorption of velamentous bands by the action of the diathermy current. The average size of applicator will be four by six inches for the lumbar pole, and three by four inches for the abdominal pole, three hundred to six hundred milliamperes should be given for about thirty minutes.

Only partial relief will be obtained from old heavy fibrous adhesions.

Case No. 50 R. Female, age 38. The patient was referred for treatment February 5, 1922, at which time she gave the following history: was operated in November, 1921, for appendicitis, after which she remained in the hospital for one month, during which time the wound did not heal and there was a gradual undermining of the surrounding integument. After she went home she was under constant medical care, despite which the pus continued to burrow until it denuded one-half of the abdomen, extending downward below Poupart's ligament and backward until it uncovered the sacrum and a part of the lumbar region. See Picture. A section of the colon, one by two inches, could be seen attached to the edges of the muscle surrounding the original incision. At this point there was a fecal fistula of nearly an inch in diameter through which complete evacuation took place. At this time, three months after the operation, she literally lay in a pool of pus.

We immediately began to give general visible-light and actinic-ray treatments, giving thirty minutes of the former and one minute of the latter. While the visible light was kept at thirty minutes each surface, the actinic rays were increased one minute daily to a period of seven minutes and this maintained. Improvement began with the first treatment and was continuous. Daily treatments were given for three months, after which the intervals were gradually increased. After two months an attempt was made to close the fecal fistula without opening the peritoneal cavity, but the tension was so great that the stitches cut through on the fourth day. On the tenth of August, six months after starting treatment, Thiersch grafts were planted on the back, notwithstanding the



Extensive abscess formation following appendectomy. Healed by visible light and actinic rays. See case report.

bowels still moved through the fistula. By having her lie on the abdomen, we lost only one graft. In one month the back was entirely healed and the abdominal wound closing gradually.

In November, we began the use of silver nitrate (pure) to the edges of the fistula neutralizing in five minutes with sodium chloride solution. In this way we were able to contract the opening so that by March, 1923, of eleven months after starting treatment, the wound was healed and the fistula closed without further operative treatment. The patient had gained nearly forty pounds in weight and was in excellent general health.

In September, 1925, she reported that her health had remained good.

Angioma.

While angiomas may affect any tissue of the body, they are usually found upon the surface or just beneath the skin. They may be classified as superficial or deep, simple or complex, capillary or cavernous.

While a few cases are seen which are acquired or traumatic, the vast majority of these cases are birth marks; therefore are congenital. They are first seen at birth or a few days after the birth of the child. Although their exact etiology is unknown, their pathology is a simple dilatation of the blood vessels which may remain as when first found or may become progressive as in the capillary or cavernous types. This takes place by lateral increase in size and number of the blood vessels from the center of the tumor which enlarges as the growth proceeds. This may be slow or quite rapid so that in the course of a few months or years the size of the tumor may be such as to be absolutely dangerous to life. Histologically these cases are simple dilated blood vessels. They are usually lined by a layer of endothelium. Occasionally they will develop in the diploe of the skull and by erosion destroy either the outer or inner table or both.

The symptoms are usually objective but in the capillary or cavernous type the cardinal symptom is pulsation synchronous with the pulse or the heart beat. In color, they range from a light pink to a very dark purple. The darker the color the more their pathology will show veins instead of capillaries or arteries. Those that are growing or enlarging are distinctly arterial and have a very free blood supply. Anything that will increase the heart's action will increase the size of the tumor showing the direct action of the heart's force upon the arteries or capillaries of the lesions causing them to dilate.

Angiomas are seldom difficult to diagnose as they are usually noticed at birth or within the first few months thereafter. Their color helps in the histological diagnosis and when the tumor begins to spread pulsation will aid in making the diagnosis of type.

They seldom cause any pain, although they may cause discomfort, especially when large or cirroid. The pulsation may be classed as an aggravation rather than a discomfort. These tumors are benign and the prognosis usually good. The rapidly growing type is the only exception and if these go untreated, fatalities may occur.

The general management of these cases has little to do with the results obtained.

Treatment means destruction of the blood vessels involved. Destructive measures may be surgical, such as tying blood vessels or extirpating the mass entirely. Drugs may be used locally for their destructive effect, among which are the weaker acids, such as carbolic, trichloroacetic, chromic, or such drugs as arsenic and zinc chloride. These are only mentioned, however, to be condemned as simpler and better methods are in the hands of the physiotherapist and by these methods most of the cases can be handled and relieved at least of most of their disfigurements.

For the superficial port wine mark, telangiectasis, or superficial capillary nevi, actinic rays from the water-cooled lamp at a distance of one-half inch or by compression, at the will of the operator, for from one to ten minutes in order to blister heavily will usually be all that is necessary for the relief of these cases. However, it is understood that the skin cannot be made absolutely the same color or texture as that of the surrounding skin surface. It can, however, be made sufficiently pink in color to be undetectable at a distance of a few feet and this is all that can be expected.

For the cavernous varieties particularly if the laking is not too large, radium, acting as it does to produce an endarteritis, will destroy the major portion of these growths. Great care must be taken in its use or white solid scar tissue will take the place of the former nevus. This, however, is better than the results from destructive drugs. After the laking has been destroyed by the radium, actinic rays from the water-cooled lamp may be used to clear up the surrounding margins in the same way that they are used for the superficial nevi.

The average dose of radium for these cases will be fifty milligrams in a pack with a screening of one millimeter of lead, one-half millimeter of brass, and one millimeter of rubber. The time of application for each area will be from thirty minutes to one hour but seldom longer than this. These applications should be repeated every three or four weeks until the desired reduction has been attained. For the very superficial cases, packs of radium may be used in the place of actinic rays from the water-cooled quartz mercury-vapor lamp. In these cases the dose is about ten milligrams for fifteen to sixty minutes repeated as soon as the erythema disappears.

The more rapid method of eradicating these growths, when not near essential structures, is complete extirpation by surgery.

It will be necessary to make an elliptic incision of sufficient size to take in a slight amount of healthy tissue outside of the nevus or angiomatous area, cutting sufficiently deep to reach the blood vessels running to the mass. These are then tied and the skin sutured as in any surgical procedure.

Electrocoagulation (using the d'Arsonval current) may be used for these cases, although it leaves a good deal of scarring and other methods are to be preferred if at all possible to attain the desired end. When electrocoagulation is used, the needle must be inserted either into the base of the tumor, using sufficient current to coagulate and destroy the blood vessels, or the area must be surrounded with a coagulated line sufficient to close the lumen of all blood vessels which reach the growth. If exceeding care is not taken this is liable to lead to a large slough, which relieves the condition, but leaves behind it a scar that is sometimes unsightly.

Actinic rays from the water-cooled lamp are valuable as an adjuvant treatment when radium is used in these cases and particularly for the radium dermatitis which usually follows its action. One or more treatments from the water-cooled lamp for a period of one-fourth to one-half or three-fourths of a minute will usually be sufficient to stop the dermatitis within a few days.

Petrolatum or olive oil to exclude the air is all that is needed to relieve the burning sensation produced by the actinic rays.

When treated with actinic rays from the water-cooled lamp 5 to 20 treatments will be needed. When radium is used 1 to 5 treatments will be required. When coagulation or surgery is used complete removal should be insisted upon.

Case No. 25. Male, age 20. Came to me February 4, 1922. He had at that time a raised dark red area covering the forehead from the hair margin downward over the eyelids to the tip of his nose, which was congenital although it had grown some the past few years.

His treatments were with the water-cooled quartz mercury-vapor lamp under compression where at all possible. The time of each treatment per area was $3\frac{1}{2}$, 8, 12, 18, 10, and 8 minutes, respectively, given over a period of seven months; the color diminished with each treatment. After the sixth treatment, the color was a purplish pink or about 80% of the dark color had been destroyed. It is never possible to remove all of the discoloration in these cases. These were very heavy treatments and produced an edema of the eyelids lasting several days and was accompanied by a great amount of burning and scabbing but not deep enough for scarring.

DIAGNOSIS: Nevus, flammeus.

Case No. 447. Female, age 8 months. Was brought to me December 3, 1924, with a raised spot on the left temple. This spot was about one inch in diameter and raised about $\frac{1}{3}$ inch above the surrounding surface. In color it was bright red. It had been

there since birth but was beginning to spread. It was not of a type amenable to actinic rays, so was given five treatments with 50 mg. of radium each of one hour's duration. The screening was 1 millimeter each of brass, lead, and rubber. They were given one month apart. The final result was a color and texture approaching normal.

DIAGNOSIS: Nevus vasculosus.

Arteriosclerosis.

Etiology. Age is a predisposing factor, while chronic alcoholism, lead poisoning, syphilis, chronic interstitial nephritis, gormondizing habits, and infectious diseases play an important part before the age factor intervenes. Business worries are frequent etiological factors and constant overworking as in the case of many day laborers.

Pathology. Arteriosclerosis is a chronic inflammation of the arteries and capillaries characterized by fibrosis and calcareous deposits within the vessel walls. The condition is known as atheroma when the intima is involved by degenerative processes.

Symptoms. The cardinal symptoms are thickened, incompressible whip-cord arteries, high blood pressure with hypertrophy of the left ventricle. Usually there is hypertrophy or dilatation of the heart, a possible nephritis followed by general weakness, dyspnea and edema or gangrene if complete occlusion occurs. Pallor and slight dyspnea on exertion with mental irritability are common early symptoms. Angina pectoris may be an accompanying symptom. Leg muscle cramps may be due to an accompanying arteriosclerosis.

Differential diagnosis depends upon the finding of other pathology which includes cerebral apoplexy or tumor, cardiac disease following acute or chronic infections, functional cardiac disease and tabes dorsalis.

Prognosis. This disease always progresses to a fatal termination which, however, may be delayed many years. Death takes most of the cases by some intercurrent malady.

Treatment. Hygiene plays an important part in the treatment. In some late cases, rest in bed is essential. In early cases, outdoor exercise as free from worries as possible and a fruit and vegetable diet will do much to prolong life. General massage is of distinct value.

Therapy. Drugs are of but doubtful value except when symptomatically given. Autocondensation will lower the blood pressure and thus help to relieve symptoms and prolong life. Ten minutes daily or twice weekly on a thick autocondensation pad, using about seven milliamperes, should be given. More is liable to cause dizziness. Do not try to reduce the systolic pressure below one hundred sixty. The pulse pressure should be about forty and its maintenance is more important than lowering a high systolic pressure.



Arteriosclerosis showing calcification of artery.

General visible-light and actinic-ray treatments will help materially and should be given with the autocondensation treatments.

Case No. 197. Male, age 76. Came to the office March 12, 1917, when he gave the following history: He was caught in a rainstorm which wet through his clothing. This was followed by pain in his left arm and shoulder, which prevented his putting on his coat for over a month.

There was pain on pressure over the brachial plexus. There was no swelling or edema. His blood pressure was diastolic 95, systolic 200 mm. of Hg. The urine was free from albumin, sugar, or casts. Specific gravity 1.008, acidity 50.

His treatments were autocondensation, 600 milliamperes for ten minutes, and diathermy through the shoulder. At the time of the eighth treatment his blood pressure was diastolic 85, systolic 125. In all he had fourteen treatments in thirty days. His blood pressure remained around 135 systolic. The pain in the shoulder disappeared after the third treatment.

DIAGNOSIS: Arteriosclerosis and Brachial Neuritis.

Arthritis.

Arthritis is due to an infective organism or trauma, therefore is a secondary lesion. The primary foci may be in any tissue of the body; most frequently, however, in the teeth, tonsils, middle ear, accessory sinuses, gall bladder, appendix, colon, or prostate gland.

A mixed infection of streptococci, staphylococci, pneumococci, gonococci and colon bacilli are the most frequent causes. Syphilis is less frequently the cause.

Gonococci are most frequently the etiologic organism of the single joint involvement.

Arthritis usually begins in the tissues surrounding the joint with extension to the synovial membrane, followed by erosion and destruction of the articular surfaces. An arthritis with a tubercular etiology is particularly liable to articular surface erosions.

Early cardinal symptoms are pain, limitation of motion, and swelling of the structures around the joints. These occur in rapid succession, sometimes requiring but a few hours. A single joint may be involved or nearly all of the joints of the body may become involved at the same time.

The blood picture usually shows a leukocytosis and in the older cases a diminution of erythrocytes and a lowered percentage of hemoglobin.

The differential diagnosis is between infection, malignancy, and traumatic lesions.

The general management is rest in bed, a non-protein diet, and a liberal hydrotherapy.

The etiology is so intangible in some of these cases, that practically every therapeutic measure known to medical science has been tried for their relief and none can be called specific.

The drugs most useful in these cases are sodium salicylate, sodium iodide or colchicin.

The physiotherapeutic treatment of arthritis consists first in active elimination through the bowels, kidneys, and skin. The bowels should be kept loose with salines for a few days and large quantities of liquids given by mouth. The skin should be kept clean by frequent bathing and active perspiration promoted by hydrotherapy followed by visible and infra-red frequencies.

Among the most valuable hydrotherapeutic measures is frequent sponge bathing with an aqueous solution of magnesium sulphate (1 to 16). The constant local application of the same solution to inflamed joints is invaluable. This is particularly true when there is fluid in the joint.

The light bath cabinet is one of our most active eliminants but must be used with caution in cases of great debility or where there are cardiac lesions. For most cases the visible light from the 1000-watt bulb is sufficient. Occasionally it is wise to use two of these at one time, one over the torso, the other over the lower extremities. The length of these treatments will have to be gauged by the condition and reaction of the patient being treated, usually from thirty minutes to several hours or if smaller bulbs are used, they may be continued indefinitely.

Dr. Kinney, Wellsville, New York, uses a frame over the patient to which several small bulbs are attached. He keeps the patient constantly exposed. The bed clothing is placed over the frame so the patient is exposed nude to the light rays. After the visible-light treatment, the patient should receive an actinic-ray treatment beginning with one minute each surface treated and increasing about one minute daily. See General Light Treatments.

For single joint involvement, it is well to use diathermy through and around the joint, but where many joints are involved, this would be an endless task although in some of the polyarthritic cases it is at times advisable to use diathermy through the joints which show greatest involvement. Diathermy treatment should be of thirty to forty-five minutes in duration, and daily until there is definite improvement, then less frequently.

Very little can be done for arthritis deformans except to relieve some of the symptoms.

Case No. 185 B. Male, age 40. Referred for treatment on April 6, 1921. The condition present was a badly swollen left hand and wrist, which were red and very painful. Even slight jarring increased the pain materially and the patient was unable to move the fingers. This condition had started fourteen days previous and

the application of a plaster cast had not relieved it. He was still suffering from a specific urethritis as evidenced by stained smears.

The first treatment was general visible light for thirty minutes over the chest and abdomen followed by a treatment of one minute with the air-cooled quartz mercury-vapor lamp, and diathermy was given through the hand. The applicators were three by four inches, one on the dorsal, the other on the palmar surface of the hand. Seven hundred milliamperes were given for one hour, at the end of which time the hand could be handled freely without inflicting pain. He was given the same treatment daily for ten days, then less frequently for four weeks, when he was discharged with almost complete function of the hand. The only other treatment used in his case was sodium iodide and guaiacol in doses of thirty-two grains of the former and three-fourths of a grain of the latter daily for the first twenty days.

The hand was X-rayed on April 17, 1921, at the Michigan Boulevard X-ray Laboratory, Chicago, with the following report: Osteo-arthritis of severe grade of left wrist joint. There appears to be considerable cartilage erosion and a marked amount of decalcification of the bones of the wrist. No X-ray evidence of caries. Other roentgenograms taken later showed improvement.

DIAGNOSIS: Arthritis, Neisserian.

Case No. 492. Female, age 29. Entered hospital for treatment on February 4, 1923. She had been ill for a month and had been unable to turn over in bed without assistance for about ten days. At the above date all joints were red, swollen, and exceedingly painful. Temperature 103, pulse 120, respiration 22. No apparent lung or cardiac involvement.

The etiology was, without doubt, infective, but we were unable to locate the original foci. There were no symptoms of appendicitis or gall bladder infection. Tonsils and teeth were normal.

Began treatments consisting of visible light and actinic rays, forty minutes of the former and one minute of the latter. The period of time for the visible light remained about the same, forty minutes, but the actinic-ray treatments were gradually increased to periods of eight minutes. Treatments were given daily for about one month and then every second day for one month, at which time she was discharged free from symptoms. After the second treatment the pain began to abate and on the fourth day the patient could turn herself in bed. She was out of bed on the tenth day and left the hospital on the fourteenth day. She reported in January, 1926, that she had remained well. No recurrence.

DIAGNOSIS: Arthritis, infective.

Case No. 246. Female, age 24. Was referred for treatment for what had been diagnosed "Sciatica." Her right knee was badly swollen and she had been unable to lie on either side for the past

seven weeks. A vaginal smear taken the first day I saw her was positive for Neisserian bacilli.

Her treatments consisted of general visible light, actinic rays, and diathermy through the knee joint. There was relief after the first treatment and she was able to sleep on her side after the third treatment. She was out of bed after the tenth and left the hospital able to walk with very little discomfort after the twentieth daily treatment.

DIAGNOSIS: Arthritis, Neisserian.

Asthma (Bronchial).

Asthma is a spasmodic dyspnea accompanied by coughing and the expectoration of large quantities of mucus containing Charcot-Leyden crystals, Curschmann's spirals made up of eosinophiles, leucocytes, epithelial cells, and large lymphoid bodies.

The spasms are largely expiratory, although there is sufficient inspiratory difficulty to bring into use the extraordinary muscles of respiration. The dyspneic spasms are supposed to be due largely to a spasmodic contraction of the bronchioles and dilated alveoli, making the condition from the pathological side an acute emphysema. If the condition continues, the emphysema becomes a chronic pathological condition.

Bronchial asthma must be differentiated from cardiac asthma for the reason that in the latter case treatment is directed to the heart and its accompanying decompensation and not to the bronchioles.

This disease must also be differentiated from laryngismus, edema or diphtheria of the larynx, and from the pressure of upper mediastinal tumors. Acute bronchitis, pneumonia, foreign bodies, and acute indigestion must be thought of. Hay fever simulates asthma, but has more involvement of the nose and accessory sinuses.

Allergic and anaphylactic reactions are frequently the immediate etiological factors. Infections play an important part in the etiology as do the various neuroses.

The cardinal symptoms are the marked dyspnea, coming on suddenly, with dilated superficial blood vessels, congested face, at times the color is almost purple, and inability to lie down. The skin is usually cold and clammy. The number of respirations per minute is reduced as the expiration is very much prolonged.

The general management of these cases includes an abundance of fresh air, the position most comfortable to the patient either up or in bed, a very light diet so the stomach is not overloaded, thus increasing respiratory distress, and cleanliness of the body both inside and out.

Treatment. Surgery is seldom of use. Drugs are recommended by the dozen, most of which are ineffectual. Life out-of-doors in an equable climate aids materially.

Adrenalin and subculoid lobelia subcutaneously give marked immediate relief. Sodium iodide 32 grains and guaiacol $\frac{3}{4}$ of a grain give more prolonged relief, sometimes for months. This should be followed by general visible-light and actinic-ray treatments for their general effect and the treatments given daily until there is definite improvement, then less frequently. Spinal vibration, especially of the lower cervicals and upper dorsals, aids many cases.

Case No. 4. Male, age 9. First severe attack of dyspnea when seven months old. Subsequent attacks were severe and at short intervals. Circumcision in 1914 improved his general health, but other asthmatic attacks recurred, though at longer intervals.

In June and July, 1916, we began the visible-light treatments, followed by the actinic rays from the air-cooled lamp of three minutes' duration, at a distance of twenty inches, and improvement was manifest after the first treatment. A few treatments in 1917 gave him complete relief for twelve months, after which he had another short series of treatments, with almost complete relief. No asthma during 1918 or subsequent years.

DIAGNOSIS: Asthma, bronchial.

Bartholinitis.

The etiology of bartholinitis is almost invariably a gonorrheal infection, occasionally staphylococcic or streptococcic.

The cardinal symptoms are pain and swelling of the gland, seldom any redness.

The pathology is inflammation and partial destruction of the gland with abscess formation. This abscess is, however, wholly encapsulated and the skin movable over it.

Differential diagnosis is abscess of lower labium majus, varicose veins of labium, and hernia. With abscess of the labium, there is general infiltration of the surrounding tissues and reddening of the overlying adherent skin. Varicose veins are free from skin adhesions and give the sensation of a bunch of angle worms slipping between the fingers. Hernia will be soft and reducible (if non-adherent), particularly so if the omentum descends with the hernial sac, while the Bartholin gland, when enlarged and abscessed, will have the feeling of a soft fibroid or well filled cyst and is best detected by placing the index finger in the vagina and the thumb external to the labium majus.

General care of these cases consists in cleanliness, diminution of friction and wet packs of magnesium sulphate, one ounce to a pint of water.

Treatment. If seen early, give local actinic-ray treatments over the gland. Use the water-cooled lamp one minute at a distance of one inch. Repeat daily. If the abscess is of several weeks' duration, no treatment is of benefit except total extirpation surgically,

which may be accomplished with the electro-scalpel or surgical dissection. The after treatment of the case is then actinic-rays from the water-cooled lamp as given for the early cases.

Case No. 546. Female, age 43. Began having pain in left Bartholin gland one month ago. It was so sore that walking was difficult.

December 14, 1918, gave a three-minute treatment with the water-cooled lamp, using a solid-quartz applicator and compression. On the 16th there was much less pain and a second three-minute treatment was given, followed by relief of pain. On the 21st a third treatment of three minutes removed all soreness, although three-minute treatments were given on the 23d and 30th, when the case was dismissed without operative work of any kind.

DIAGNOSIS: Bartholinitis.

Case No. 38. Female, age 29. Came for treatment October 11, 1915. Physical examination disclosed fluctuating mass in the lower portion of the right labia, which she informed me had been lanced fifteen times with recurrence each time. As lancing does not heal abscesses of the Bartholin glands, I extirpated this one surgically with complete recovery.

DIAGNOSIS: Bartholin Abscess, Neisserian.

Bell's Paralysis (Facial paralysis).

This is usually classed as a simple neuritis and has for its most frequent etiology continued exposure to cold winds with trauma as a close second. It usually starts a day or two following the exposure and its first symptom is mere discomfort which may scarcely attract attention. This is followed in a day or so by complete paralysis of one side of the face. It usually involves all of the branches of the trifacial nerve, although in rare instances only one or two branches may be affected. There are no general symptoms as the condition is entirely local. General symptoms mean complications.

There is neither a characteristic blood picture nor any bacteriology.

The pathology is simple nerve inflammation.

General treatment consists in avoiding any further exposure.

Drugs are of little value.

Physical Therapy. Visible light is the most valuable agent for the treatment immediately following the paralysis. This may be followed by actinic rays from either the air- or water-cooled lamps. While the visible-light treatments may be prolonged indefinitely, the actinic-ray treatment should be very short, just enough to produce a mild hyperemia. After the first week use a mild, rapid sinusoidal current for five minutes daily, and after the second week change from the rapid sinusoidal current to the slow sinusoidal,

using just enough current to contract the facial muscles. Apply one electrode to the upper cervical region posteriorly, the other to various parts of the face, particularly over the zygoma. The sine current should be given for five minutes daily following the phototherapy application.

The prognosis is good, although it may be impossible to restore all muscles to complete function.

Case No. A4. Female, age 42. Came to us with complete motor paralysis of the left side of the face, which had followed exposure to a cold wind. There was no pain or swelling.

The first treatment was visible light for thirty minutes over the face, after which there were daily visible-light treatments of twenty minutes. After the fifth day, we used the rapid sinusoidal current in addition to the visible light for ten minutes, using just enough current to be felt. These treatments were given every second day. At the end of the second week, we changed the rapid for the slow sinusoidal current to contract the muscles, thus preventing atrophy, and continued the visible-light treatment for ten minutes. After the third month she was able to close the eyelids and the face muscles were so nearly normal it was difficult to detect any paralysis.

DIAGNOSIS: Bell's Paralysis.

Bronchitis.

Bronchitis is an inflammation of the membrane lining the bronchi, but not the bronchioles, which when involved include the alveolar structures and the inflammation then becomes a true broncho-pneumonia. Types—acute and chronic.

Differential diagnosis. Acute. Seldom, indeed, are the bronchial tubes alone inflamed; usually the case starts as a simple coryza, which, following the air passage downward, inflames the larynx, trachea and finally the bronchi. Broncho-pneumonia may be a final involvement to the above, or it may start as a primary lesion within the lung. Lobar pneumonia is always primary within the lung.

Should the inflammation extend to the bronchial capillaries we have a capillary bronchitis, differing from the pneumonias in that there is an absence of consolidation. In cases of capillary bronchitis the symptom dyspnea is very marked, due to the obstruction of the passage of oxygen into the lungs by the mucus engorgement of the capillaries. In these cases toxic absorption is excessive even to coma.

The differential diagnosis between capillary bronchitis and broncho-pneumonia is at times very difficult, although the capillary bronchitis occurs mostly in the extremities of age. Incipient or military pulmonary tuberculosis must be remembered when making

the diagnosis. Bronchiectasis and emphysema must not be forgotten.

The pathology is true inflammation of the mucous membrane lining of the bronchi with all its characteristics. The mucus glands are hyperactive and the mucus contains epithelium and blood cells, both erythrocytes and leukocytes.

The etiology is usually a bacterial invasion of streptococci or influenza bacilli. It may accompany exanthemata or it may be traumatic.

Symptoms. The cardinal symptoms are: pain and cough, usually a slight fever up to 102° or 103° F., mucus rales. There is seldom any dyspnea, except in the capillary type. Palpation and percussion are negative.

Diagnosis is largely by exclusion and the retention of the cardinal symptoms; early pain, cough, and later in the course of the disease excessive mucus secretion.

Treatment is directed toward a reduction of the congestion and inflammation of the bronchial mucous linings. This is most easily accomplished with visible light over the chest and abdomen, front and back, for a minimum of one-half hour and a maximum of one hour once to thrice daily followed by a one-minute treatment of actinic rays, the time of the latter increased one minute daily for the first ten days.

Drugs. Bryonia 1/100 of a grain, ferrum phos. 1/100 of a grain or antimonium arsenite 1/100 of a grain are of value in loosening the mucus, thus aiding in its removal. Sodium iodide and guaiacol intravenously are also of value.

Chronic Bronchitis.

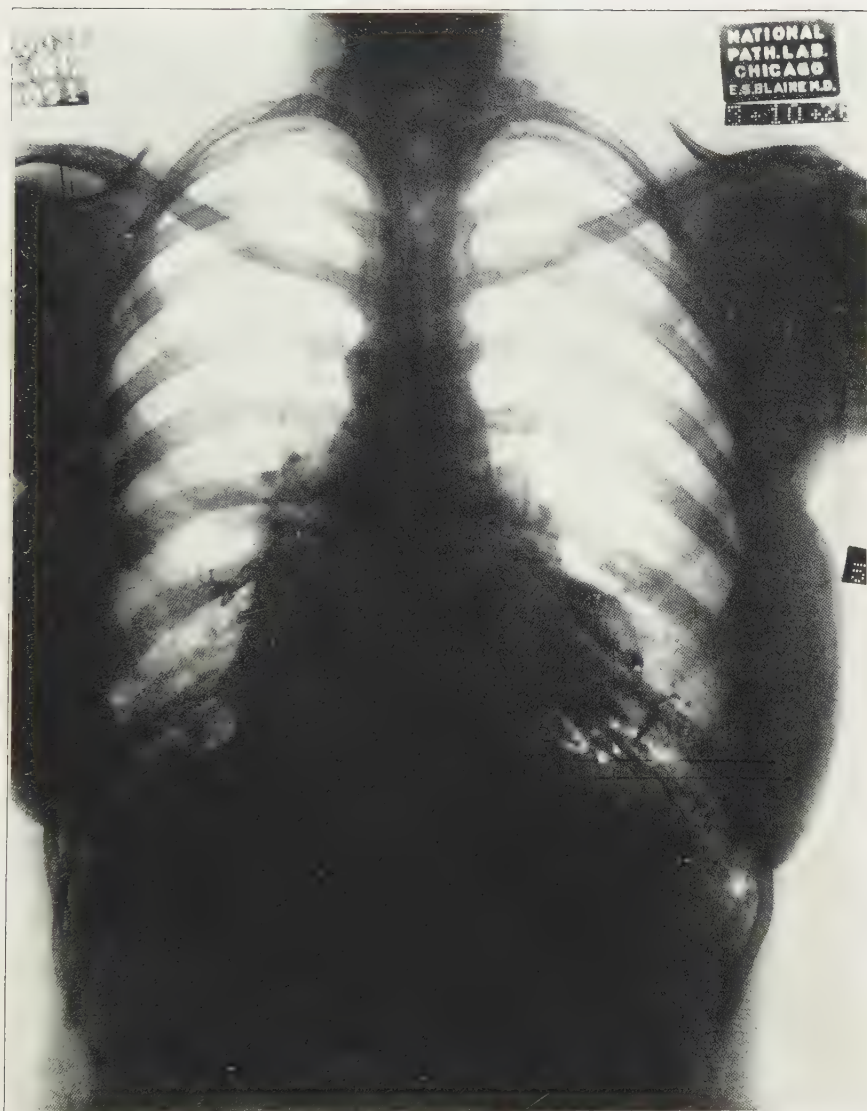
Chronic bronchitis is largely a disease of the aged, with repeated attacks of acute bronchitis blending into continuity as its main etiological factor.

Pathology. The associated pathology is a dilatation of the alveoli, with varying degrees of destruction of the elasticity of their walls and a continuous low grade inflammation of the bronchial mucous membrane, causing hyper-secretion and more or less continuous coughing spells, which are increased by cold or exertion.

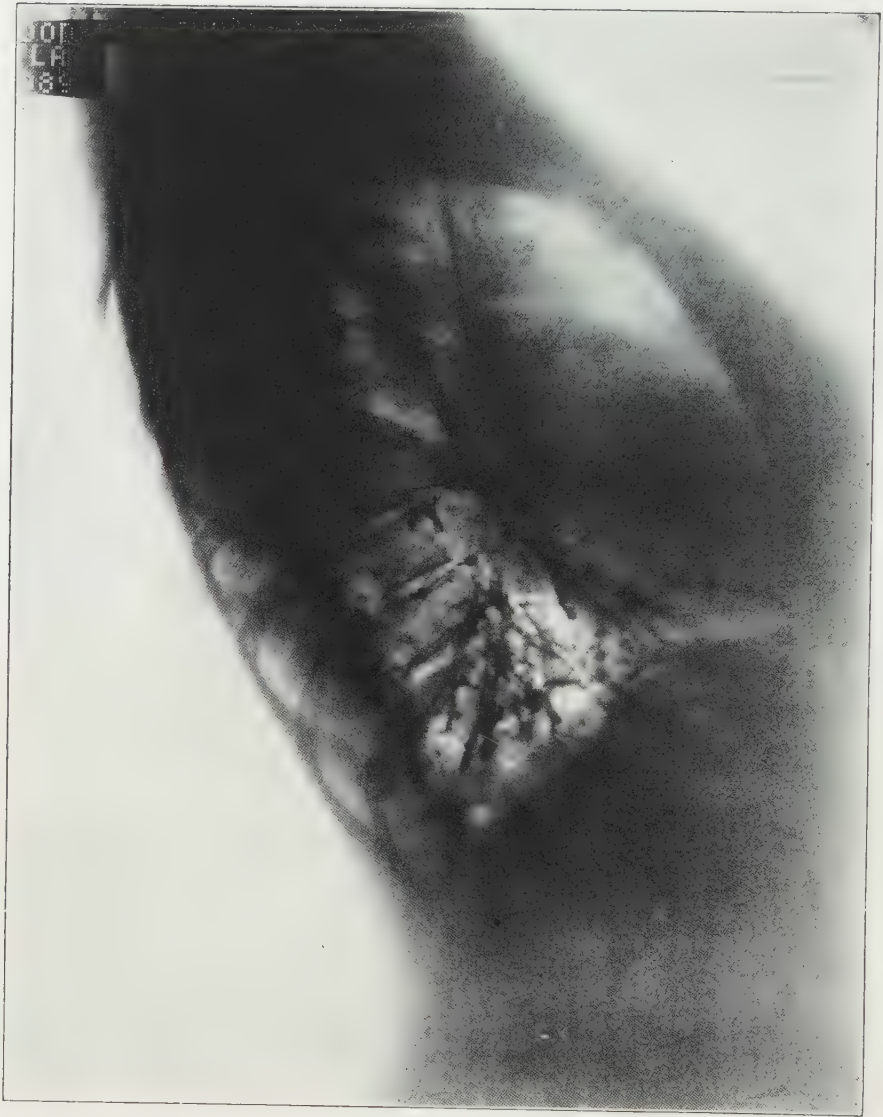
Dyspnea and varying degrees of cyanosis are always present. Because of the increased oxygen effort, cardiac dilatation is likely to occur with or without hypertrophy.

Percussion gives a hyper-resonant note. The distended blue veins over the thorax bespeak increasing pathology.

Treatment of chronic bronchitis is much the same as that for acute, but must be continued for months. A regulated diet, light but nutritious, with the heavy meal at mid-day, must be insisted upon. Physical exertion must be decreased to a minimum and life in an equable climate where the patient can live in the open is to



Posteroanterior projection of thorax in lipiodol injection—transglottis. The heavy opaque material passed into both bronchi filling the distended tubular passages indicating typical bronchiectasis close to the lung root.



Lateral projection of thorax in lipiodol injection—transglottis. Shadows showing the opaque material in the dilated air passages principally on the left side. Characteristic X-ray appearance in bronchiectasis.

be desired. Close, stuffy, and overheated rooms aggravate the dyspnea and increase the discomfort of the patient. Opiates should be avoided, as should constipation.

Drugs. Arsenicum iodide 1/100 of a grain, spongia 1/1000 of a grain, antimonium arsenite 1/100 of a grain, sanguinaria nitrate 1/100 of a grain are of benefit.

Nothing in drug medication equals the use of general visible-light and actinic-ray treatments for disorders of the bronchi. The former decreases the congestion of the bronchi by dilating the superficial vessels and at the same time places the blood where it can best absorb the actinic rays during the latter part of the treatment, thus changing acidosis to alkalosis. These treatments should be given daily until there is definite relief, then as frequently as are needed to keep up a definite improvement. Chronic bronchitis and bronchiectasis will require treatment from several weeks to several months.

For chronic bronchitis, but particularly for the acute case, magnesium sulphate packs (one ounce to a pint of water with a temperature comfortable to the patient) over the chest between treatments affords very great relief.

Case No. 137. Male, age 35. Became ill ten days ago. Had pain throughout the chest; chilly at times; coughed severely. When he came to us on August 14, 1916, his temperature was 101.2; pulse, 100.

The first treatment consisted of twenty minutes of visible light and three minutes of actinic rays from the air-cooled lamp, at a distance of twenty inches. On the 15th the temperature was 100, pulse, 90, when the treatment was repeated, increasing the actinic rays to four minutes. The following day the temperature was 99.

Treatments were repeated on the 17th and 18th, when he received twenty minutes of visible light and five minutes of actinic rays, at a distance of fifteen inches. He was dismissed at this time with a temperature of 98; pulse, 72.

DIAGNOSIS: Bronchitis.

Bronchiectasis.

Bronchiectasis is usually secondary to chronic bronchitis.

Pathology. Its pathological picture is much the same with this difference, that not only are the bronchi dilated but the alveoli as well. If the sacculations are large and pendant, they retain the secretions until they become fetid and if ulceration occurs there may be free hemorrhages. The quantity of secretion may amount to several pints daily. Naturally this leads to a great deal of coughing, particularly in the mornings. These patients are bed-ridden or nearly so.

Diagnosis will depend largely upon the clinical history and the kind and quantity of the secretions but must be differentiated from

chronic pulmonary tuberculosis, which, however, usually occurs before middle life, while bronchiectasis usually occurs after middle life and the general physique does not suffer much. Many of these cases occur in the obese. Bronchiectasis must also be differentiated from chronic bronchitis, which it usually follows, and from abscess or gangrene and localized empyema. Iodized oil instillations followed by roentgenograms give a definite diagnosis. (See Plates XXII and XXIII.

Auscultation and percussion will reveal cavernous breathing and tones.

Treatment is the same as for chronic bronchitis, although recovery will be slower.

Sodium iodide and guaiacol (32 grains of the former and $\frac{3}{4}$ grain of the latter) intravenously will help to loosen the secretions and diminish the odor. These may be given daily to twice weekly. Use emetin hydrochloride, one grain, intravenously for hemorrhage.

Case No. 376. Female, age 51. Wife of a physician.

She had had a cough accompanied by a very fetid expectoration for several years. There had been bleeding for one year, which at times was very copious, despite continued medical treatment and a sojourn in Denver.

She entered the hospital November 13, 1921.

Her treatments consisted of general visible-light and actinic rays with emetin hydrochloride, one grain intravenously for the bleeding. These were given daily. After the tenth treatment there was no bleeding and the cough was very much improved. At the end of the fifth week she was able to leave the hospital, at which time there was a marked diminution in the quantity of expectoration. A few days after returning home, there was a return of the bleeding and she returned to the hospital. She was given the same treatment and remained in the hospital for about two months. She then returned to her home but continued the treatments. During this time there was no bleeding and for several years she has had little or no expectoration or coughing. At the present time, June, 1926, there is no return of the trouble.

DIAGNOSIS: Bronchiectasis.

Bubo.

Bubo is understood to be a special adenitis of the inguinal glands due to venereal infection, either chancroidal, gonorrheal, or syphilitic, hence the above indicates their etiology.

Pathology is an inflammation, abscess formation, or ulceration of these glands and the surrounding tissues, rarely involving the femoral vessels, although occasionally producing a phlebitis.

Symptoms. Their cardinal symptoms are those of infection: enlargement, pain, and redness, accompanied or preceded by an

infection of the genital organs, either as an open sore or sores, or as a urethral discharge.

General care. In severe cases, confinement in bed is obligatory. Ordinarily the case is ambulatory with caution to move about as little as possible. The diet should be light and liquids should be taken in large quantities.

Bubo must be differentiated from granuloma inguinal.

Treatment. Simple drainage, if pus has formed. If no fluctuation is palpable use the water-cooled quartz lamp one minute over the inguinal region at a distance of one inch, or the air-cooled quartz mercury-vapor lamp at a distance of two inches for three to ten minutes daily, preceded by visible-light for ten to thirty minutes. Sodium iodide and guaiacol (32 grains of the former and $\frac{3}{4}$ grain of the latter) will aid.

The etiological factors must be treated separately and if not removed, will continue the infection indefinitely.

The average length of treatment will be from two to four weeks.

The prognosis is good, although some cases will take many weeks to heal.

Bunion.

A *bunion* is an inflammation of the inner metatarsophalangeal bursa affecting to the greatest extent the head of the first metatarsal bone. It may be either acute or chronic.

Its etiology is usually an intermittent trauma, mild in type, as friction or pressure of a shoe, especially one which pushes the toe outward, causing increased friction or pressure on the head of the metatarsal bone. Severe trauma or hematogenous infection are etiological factors in the acute types.

The cardinal symptom is pain, particularly when the bursa is under compression. The surface is usually red and may be edematous. If infection occurs, there is an increase of the pain and a distinct throbbing.

The treatment consists of relieving the irritation and pressure. The use of actinic rays from the water-cooled lamp for a half minute twice a week and nocturnal applications of magnesium sulphate solution (1-16) as a wet dressing.

Surgery will be needed for the release of pus and for the removal of bone deposits. The physiotherapeutic treatment of these cases will take from one to several months.

Case No. X1. Female, age 37. Came to the office January 27, 1922, complaining of pain at the base of the right great toe. Inspection revealed a marked enlargement at the point complained of, with swelling, redness, and edema. The bone was slightly enlarged, but the soft tissues markedly so. Pressure over the en-

largement disclosed softening and fluctuation. This was lanced but not irrigated or packed; wet dressings of magnesium sulphate solution (1-16) were applied and daily treatments were given locally with the water-cooled lamp of one minute duration. A few days were sufficient for complete recovery of the infection and a marked reduction in the size of the enlargement.

DIAGNOSIS: Bunion, infected.

Bursitis.

Bursitis may be either acute or chronic.

Its etiology may be infection, trauma, or tuberculosis.

In pathology it may be a simple inflammation of the brusal lining with hydrops, or it may contain infective material, usually the former.

Symptoms. Cardinal. Enlargement of the bursal cavity with tension and discomfort, which is increased on movement. Usually there is no redness or elevation in temperature, either local or general, and no increase in pulse rate. Usual sites are about the knees and shoulders.

General care. Rest is not imperative unless hydrops is severe. Tapping gives only temporary relief. Diet has little or no influence on the course of the disease.

Treatment. Magnesium sulphate, one ounce to a pint of water, as a continuous wet dressing, or at least continuous during the resting hours. Actinic rays from the water-cooled lamp, daily to twice weekly at a distance of one-half inch for one to two minutes, or diathermy concentrated in the bursal sac not over 50 milliamperes for each square inch of the smallest electrode for not less than twenty minutes will hasten the restoration to normal.

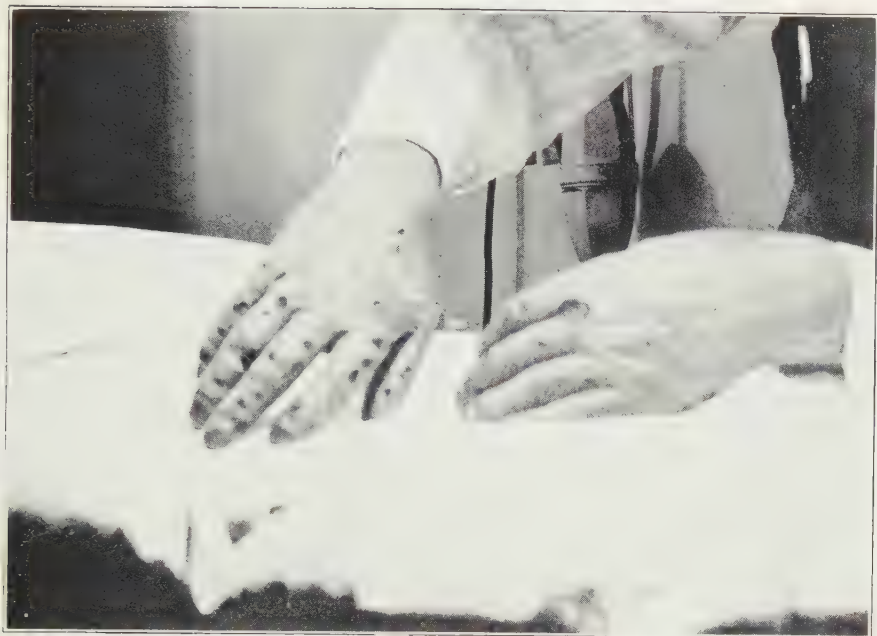
Surgical excision is a curative measure.

Burns.

Burns have for their etiology chemical or thermal action, providing X-rays and radium are excluded. Even these should be included in the chemical etiology, as the rays from both are actinic or chemical.

Pathology. They are usually classed as first, second, and third degree burns. First degree meaning superficial blistering, second degree burns are those which destroy all layers of the skin, and third degree where tissues below the skin are also destroyed. The latter are usually fatal if the area is large.

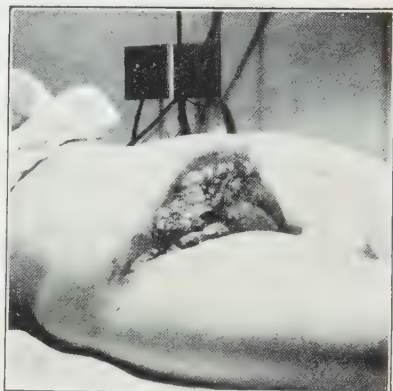
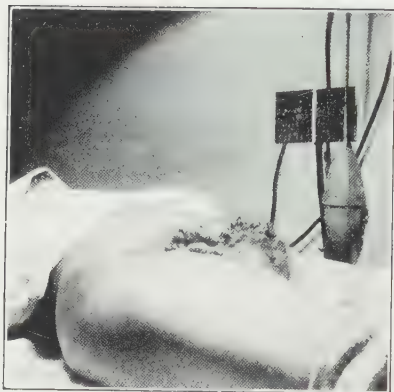
Symptoms are immediate blistering or charring, later sloughing. Both stages are accompanied by shock and pain, both of which are in proportion to the amount of tissue destroyed. Bleeding may accompany the sloughing, odor always does. Toxic symptoms are also in proportion to the amount of the destructive process and come on with the sloughing, but unless there has been



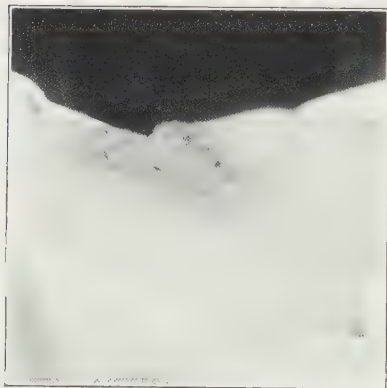
X-ray burns of eighteen years' standing.



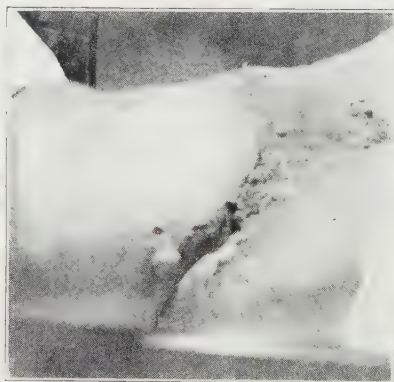
After three months of visible-light and actinic-ray treatments following desiccation.



X-ray burn and carcinoma developed thereon after treatment
for uterine fibroid.



Appearance after three months
of treatment.



Front view same case.



X-ray burn in case of leukemia.

serious damage to the heart, kidneys, etc., will usually disappear with the slough and the establishment of the repair process.

General care. Supportive measures and sedatives will be required for the first few hours or days.

Treatment. Local applications to exclude air and for local sedation will be required. A five to twenty per cent solution of oleum terebinthinae in oleum olivae is of definite benefit, both for sedation and as an antiseptic. Petrolatum is at times all sufficient, or calendula succus added in a ten per cent ointment will be found helpful. Picric acid in a saturated solution is useful for superficial burns, and in emergency as a first aid do not forget sodium bicarbonate in a thin watery paste. Paraffin preparations are of definite value in some cases to exclude air.

After the primary shock has passed, more or less continuous visible-light at a comfortable distance will aid materially and will keep the wounds open instead of heated with heavy pus-saturated dressings. After the first forty-eight hours, begin treatment with the actinic rays for their antiseptic action. Begin with a few flashes from the water-cooled lamp at a distance of one inch, or the air-cooled lamp at a distance of twelve inches for one minute, gradually increasing the time, but always being careful not to blister. These treatments should be repeated daily, but the visible-light may be used almost continuously if used at a sufficient distance. Phototherapy treatments leave a soft pliable scar.

If chemical burns are seen early, neutralize; if seen late, treat as for heat burns.

X-ray and radium burns are in a class by themselves. They come on in from ten days to months after the exposure and their sloughs remain attached in some degree until healing takes place, which may be years afterward unless removed surgically. Air-excluding agents do not act as sedatives in these cases, as the pain is due to nerve irritation. Even morphin hypodermically fails to relieve some of them. Their surfaces are covered with a thin, soft, yellowish-white scab, which cannot be detached without bleeding, but which disappears with the healing process.

Treatment. If it is known that an excessive dose of radium or X-ray has been given, do not wait for the hyperemia, but start in giving actinic-ray treatments at once, using the water-cooled quartz mercury-vapor lamp at a distance of one inch, or the air-cooled at a distance of two inches for one minute, gradually increasing the length of the treatment as required, but not beyond three minutes with the water-cooled lamp or ten minutes with the air-cooled. This same treatment applies to cases seen during the first few months after exposure. For the older cases where there is extensive keratosis or ulceration, it will be necessary to remove these by desiccation (Oudin current) before starting the actinic-ray treatments, as the actinic rays from the quartz lamps will not

penetrate them. After removing the keratosis or ulceration, use the treatment as outlined above, at times adding the visible light to produce a good hyperemia and to relieve lymph and blood stasis. In these cases antiseptics will not be required, although bland oils will aid in preventing the adhesion of dressings.

At times granulations can be stimulated by using wet packs of magnesium sulphate, one ounce to a pint of sterile water. The dressings should be sterile gauze, which may be saturated with a bland oil if they tend to adhere to the wound surface. If the wound is exceedingly painful, add Butyn from two to five per cent to the oil dressing or to a ten per cent calendula succus cerate, which may be used instead of oil. This will give immediate relief without the use of opiates.

Prognosis is good if vital structures are not involved. The acute burns will heal in a few days, while several months will be required for the chronic cases. For large areas, Thiersch grafting will help to shorten the time of healing. Do not graft until the entire area is covered with healthy granulations.

Case No. 383. Female, age 33. Was referred to me May 1, 1921. Six weeks previous to this date she had been given a gastrointestinal examination with roentgenograms. An area of dermatitis about 4 inches in diameter over the upper lumbar and lower dorsal region resulted from this examination. The skin had been broken for one week.

She was given a one minute treatment with actinic rays with the lamp at a distance of six inches. The next day she was given a two minute treatment and the third day a three minute treatment, which completed the healing, although she was given a three minute treatment the next day. She was seen several months later and reported no return of the trouble.

DIAGNOSIS: X-ray Dermatitis.

Cancer.

First, we do not know the etiology of cancer, although trauma is a frequent accompaniment in the history of sarcomas. Second, there is an ever increasing knowledge both on the part of the lay public and the medical profession, as well as other scientific bodies, that cancer is a disease of civilization or of civilized methods of living. In short, there is something about our mode of living that aids and abates cancer cells. In other words, our resistance to their invasion has been lowered. This should not be so, for the civilized world is far healthier in general than it has been since the dawn of history. Many diseases are on the wane, many are controlled by various scientific means. Leprosy is now a rare disease. Plague is well controlled in most countries except in time of war. Malaria and yellow fever have lost their horrors.

Tuberculosis is known to attack mostly the undernourished, overworked, ill-housed, light-deprived, air-infected portion of our population and is controlled to the extent to which we can change these conditions.

What the "something" is that causes cancer or the lack of which allows cancer to develop is not known. That cancer is rapidly increasing in all civilized countries is easily ascertainable from the statistical reports of these nations. In England in 1838 the death rate from cancer was 173 per million population, in 1892 it was 690, while in 1922 it was 1,229, or more than seven times what it was in 1838. In the United States, to quote from F. L. Hoffman, author of "The Mortality of Cancer Throughout the World," during the period of 1912-15, 38 cities in the United States with a total population of 22,000,000 had a cancer death rate of 87.9 per hundred thousand. During the next five years the rate increased to 95.4 per hundred thousand, and during 1921 to 101.5.

The increase in cancer is a fact, and not a statistical fallacy. Sir W. Arbuthnot Lane says, "By no known means can we *cure* any chronic disease." If this be true, then we should try to prevent chronic diseases. We know that according to present methods of treatment the best we can do for cancer cases is to remove the visible growth where this is at all possible, and it is possible only when we can get the case early and by early we mean before extensive or distant metastasis has occurred. Where the proximate metastasis does not involve essential structures or organs, they can and should be removed enbloc with the growth.

However, we as medical men, should go further than this. There is no doubt but that cancer is on the increase, neither is there any doubt but that this increase is due to something occurring in the living conditions of civilized humans and domesticated animals. Books could be and have been written of evidence to prove this assertion, so space will not be taken to reproduce that evidence, for it is easily obtainable in any first class medical library.

Cancer claims its victims largely from the very opposite civil conditions that allows tuberculosis to develop. In tuberculosis, we find bad housing, underfeeding, lack of sunshine and fresh air, all of which are usually associated with poverty. Primal etiological factors of cancer cases, on the other hand, are more frequently found among the well-to-do who are well housed, and overfed or rather badly fed, who usually have an abundance of fresh air and, while they usually protect themselves directly from the sun, their surroundings are bathed in bright sunlight. From gross, external, superficial appearances it would appear that this class should be the last to be affected. However, if conditions are closely analyzed, they will be found to contain many elements that tend toward ill-health of various kinds.

Bright sunshine tends, in a limited number of cases, to produce keratosis followed by cancer of the integument in those who are exposed to it daily for years in succession, but these cases are usually simple and do not tend to metastasize.

Fresh air is beneficial to all humans and animals so far as known. The housing of most people in good financial circumstances is usually all that could be desired, therefore we have their food and general bodily habits to consider.

Civilization has demanded certain proprieties and conventions since its inception and these requirements have grown as civilization has grown until at the present time, one can scarcely be natural or act naturally. The penalty of so doing would be social ostracism if not a jail sentence.

Dense centers of population demand certain health regulations, if the populace is to live at all, which in themselves are right and proper, although they may work harm to the individual. On the other hand, dense centers of population mean lack of local production of food stuffs which are absolutely essential to life. This absence of food production means that foods must be transported long distances and some means provided for the preservation of the food not only during the period of transportation but during the time of its preparation and after its arrival in large cities until it can be consumed. Storage facilities in the homes of city dwellers are very limited and are becoming more so as the density of the population increases with its corresponding increase of land values and rents. This means that the foods raised at a distance must be so prepared as to keep for long periods of time. In the United States today, it is something like nine months between the grinding of the wheat and the consumption of the flour, and it is more months and sometimes years between the raising of the wheat and its being milled.

Scientists may be both a necessity and a scourge. They have taught us how to analyze and prepare our food stuffs to prevent their decay or infestation by various parasites and to this extent we are wholly at their mercy if we wish to live in large centers of population. On the other hand, in preparing our food stuffs so we may consume them months or years later, they have removed some of the most essential parts, the minerals, the vitamins, and the roughage. In the case of flour about 30% of the grain is milling by-product. These by-products, by refined taste and social custom, we have relegated and bequeathed to the lower animals to their benefit and our harm.

McCullom and many others have proved experimentally that it is not possible for certain birds and animals to live on flour as milled today, but if even after the birds and animals have become helpless, they are given a small portion of the 30% milling-waste they can be restored to health. The "something" in this 30% waste

has proved to be largely roughage with a small percentage of minerals and a very much smaller, although very much more essential, percentage of what we now choose to call vitamins.

Vitamins.

The quantity of vitamins necessary for health may be but a small fraction of a grain each day, but it is absolutely essential to health and, many times, to life itself. Of these vitamins there are several types scientifically known as vitamin A-B-C-D-E, etc. each having a definite field of usefulness and happily designated by letters rather than coined names, thus avoiding confusion of substances so closely related. What has been said of flour could be repeated with variations regarding sugar, cereals in general, etc.

Cereals are deficient in calcium, sodium, and chlorine elements and in fat-soluble A and water-soluble B, hence the necessity of supplementing these with milk products and leafy vegetables.

Regarding further vitamin destruction, it may be said that prolonged heating or freezing destroys vitamins A and B, although ordinary cooking does not destroy fat-soluble A, neither does sun-drying of leaves of plants. Water-soluble B, which is antiscorbutic, is readily destroyed by weak alkalies, according to McCollum in his "Newer Knowledge of Nutrition" (page 136), therefore soda should not be used in cooking vegetables containing this vitamin which are principally leafy vegetables and plants, milk, eggs, glandular organs, orange and tomato juice. Seeds, tubers, and muscle meats contain but a minimum amount.

Hess determined that heating to 145 degrees for thirty minutes did not destroy fat-soluble A, but that keeping it on ice for forty-eight hours thereafter did, so the time factor of keeping food will have to be considered.

Animal fats contain but a small amount of fat-soluble A, butter fats contain the largest amount. McCollum further states that there is no experimental evidence that wheat is superior to oats, corn, barley, or rye, but that they are all very closely related in their dietary properties and are used separately largely as a habit by different nations. He also states that bolted flours are nutritionally inferior to whole grain products and that we should realize that none of our vegetable foods or the meats are complete and ideal foods and that all have varying deficiencies. Milk and leafy vegetables, and eggs to a less extent, are to be regarded as protective foods and equally essential, and should be used to supplement the more nutritious but less vitamin containing foods.

McCollum further states, "No thorough studies of the dietary properties of fruits have yet been made, but from their known chemical composition and biological functions as storage organs, their proper place in the diet can be predicted. They are good sources of mineral salts and of energy-yielding foods as the sugars.

They are highly palatable and exert a favorable influence on the excretory processes of the kidneys and the intestines. Their liberal use in diet should be encouraged."

Peanuts, soy beans, and cotton seed serve only as an inadequate supply of fat-soluble A as a protective.

The conclusions of McCollum were "that it is unwise to approach very closely the physiological minimum with respect to any dietary factor. *Liberal consumption of all of the essential constituents of a normal diet, prompt digestion and absorption and prompt evacuation of the undigested residue from the intestine before extensive absorption of products of bacterial decomposition of proteins can take place, are the optimum conditions for the maintenance of vigor and the characteristics of youth.* Such a dietary regime can be attained only by supplementing the seed products, tubers, roots and meat, which must constitute the bulk of the diet of man, with the protective foods, milk, eggs and the leafy vegetables. There is no substitute for milk and its use should be distinctly increased instead of diminished, regardless of cost."

These "protective foods" are, of course, supposed to be fresh for when we tin them, freeze them for long periods, dry them with preservatives, bleach them with chemicals, and remove the mineral elements there is little left of their protective value. How people are going to live in large centers of population without these preservatives is an unsolved problem and how they are going to live and be well with them is a problem for the future to settle if it can. Home cooking is all but a lost art, and in view of the scarcity and inefficiency of help, public eating places are replacing the fresh vegetables more and more with the canned or preserved, thus the people are being more and more deprived of "protective foods."

"Protective food" elements are abundant in leafy vegetables such as dandelions, sorrels, nasturtiums, beet tops, mustard leaves, spinach, lettuce, cabbage, kale, brussel sprouts, etc.; some of these should be eaten raw—others cooked to increase their digestibility.

These foods are particularly valuable for growing children and nursing mothers. These are alkaline producing foods, and counteract the effect of the acid producing foods, such as cereals, meats, tubers, and roots. Milk and most fresh fruits, particularly the citrus fruits, are also alkaline producing.

Actinic or chemical rays increase the vitamin content of various foods when irradiated by light from the quartz-mercury lamps and if a human being is irradiated by a large amount of sunshine (hours) or a small amount of rays from the quartz-mercury lamps (minutes) he needs less of the vitamin carrying foods. To a limited extent, one replaces the other.

In active life, we find this well pictured in the health of the soldier whose diet is deficient in vitamins in time of peace and

almost devoid of them in time of war. His health is maintained under these conditions by his active outdoor life in field or camp where his exposure to fresh air and sunlight make up for the deficiencies in his diet.

The average person will not, cannot, or at least does not, seek his actinic rays in the open country, therefore he must supply his vitamin needs from his foods. Milk, and milk products, eggs, fruits, tomatoes, and green leafy vegetables are available at least once a day in most homes and restaurants. Strict diets, except in a few diseases, are to be condemned, for they keep from the individual the vitamin elements essential for the maintenance of health.

As already stated, we now have vitamins, A, B, C, D, and E, of whose physiological functions we are fairly certain, and more will be added as time and scientific investigation will reveal them.

Analyzed separately, vitamin A is the one that is associated principally with animal fats. Cod-liver oil is the richest known source of this vitamin and is said to contain 250 times as much of it as butter fat, which is our main source of supply. To a less extent, we rely on cream, whole milk cheese, and egg-yolk for our needs. Liver, heart, and kidneys of animals are rich storehouses of vitamin A, but civilized man is drifting away from these foods. Fresh green leafy vegetables, as spinach, lettuce, cabbage (raw), alfalfa, green peas, and beans are rich in vitamin A. Tomatoes contain it in abundance. Chlorophyll and plant pigments apparently act as storehouses for this vitamin. Fruits, as a whole, contain only a small quantity of vitamin A.

Carnivorous animals always eat the organs of their prey before consuming the flesh. This is probably an instinctive knowledge that these parts contain essential food substances. Young animals lose weight unless supplied with a sufficient amount of vitamin A, which goes to prove that whatever its chemical properties, it also contains potassium. Their vitality is lowered if this vitamin is given in insufficient quantity and their immunity is lowered in direct ratio with its deficiency.

In both man and animals, xerophthalmia is a characteristic affliction and is destroyed by adding vitamin A to their diet. This is real specific medicine and this type of prescribing will be the practice in a few years, and it is not necessary to purchase it at the drug store, for the vegetable and fruit store is a more economical place at which to obtain it. Where there is a lack of assimilation, there is also a shortage of vitamin A.

Vitamin B is the anti-neuritic and anti-beriberi vitamin and it is the most widely distributed of all the vitamins. It is abundant in green plant tissue, as is vitamin A, thus they are associated in nature in plant growth as well as in the growth of man and animals. Cereals and seeds of all kinds are rich in vitamin B, most of which is to be found in the seed germ. Brewers' yeast and the

wheat germ are the standard sources for the supply of vitamin B in experimental work. Tubers and roots, as well as tomatoes, contain it in abundance and to a less extent it is found in most fruits and nuts. Muscle meats contain it but to a less extent than the heart, liver, and kidneys. There is but a negligible quantity in the flesh of chickens, turkeys, ducks, geese, and guinea fowl.

When the germ and seed coats are removed from grains, nearly all of the vitamins go with them, as very little is contained in the starch.

In the young, a lack of vitamin B, as well as vitamin A, results in a stunting of the growth with loss of appetite. In the adult, there appears various functional disorders which, if not corrected by the addition of a sufficient quantity of vitamin B, will result in organic disease and death.

Vitamin C is antiscorbutic and its best sources for man are lemons, oranges, tomatoes, cabbage (raw), lettuce, spinach, green beans, peas, and turnips. In short, green vegetables, fruits, tubers, and sprouted grains are the sources of supply. By referring back you will see that vitamin C is associated with vitamins A and B. Milk from pasture-fed cows contains vitamin C in quantity, while milk from stall-fed cows contains less than one-half as much and this decrease occurs in spite of ensilage feeding. Preserved and dried fruits and vegetables are deficient in this vitamin.

Vitamin D is antirachitic and like vitamin A is fat soluble, that is, it is found principally in animal fats and to a slight extent in vegetable fats. The greatest source of supply of vitamin D is in cod-liver oil, while vegetable oils, as cotton-seed oil, corn oil, and olive oil are nearly devoid of it. Olive oil can be made antirachitic by spreading it in a thin layer and radiating it with actinic rays from the quartz mercury lamp for thirty minutes at a distance of two feet. When thus rayed, Professor Steenbock of the University of Wisconsin says it will retain its antirachitic property at least a year. The green vegetables and fruits have no antirachitic properties as they do not contain vitamin D, although they contain rich supplies of A, B, and C.

There has been very little scientific work done toward the study of vitamin D in the plant world. It is known that it is much more stable than vitamin A.

Vitamin D has a certain control of the assimilation of calcium and phosphorus, but as actinic rays also have a controlling factor over these same elements, it immediately brings up the question whether or not vitamins and chemical light rays are not very closely associated. The fact that Professor Steenbock has been able to ray olive oil with the quartz-mercury lamp and get it to retain the antirachitic property for one year causes one to stop and ponder whether or not vitamins are but stored chemical rays. This may explain why no one has been able to separate a

vitamin from its carrier, be that oils, fruits, or vegetables. We are getting near that intangible something called life.

Animals on a rachitic diet, that is one containing no vitamin D, quickly develop rickets if kept in the dark, but do not do so if kept in direct sunlight, thus proving that there is something in the sun's rays that is a complete substitute for vitamin D.

This *something* is removed from the sun's rays if glass is interposed between the sun and the animal. Scientists know that glass is opaque to the short actinic rays, therefore we know what this *something* is—that which is excluded when glass is interposed. Lettuce, spinach, grains, etc., are activated with vitamin D when exposed to the rays from the quartz mercury lamps for thirty minutes at a distance of two feet (Steenbock).

The radiation of cows with quartz-mercury light increases the antirachitic property of their milk. The same thing occurs in egg-yolk when hens are radiated.

Cholesterin from any source is readily activated by actinic rays.

Pure fat, as lard, or water, or gelatin, cannot be activated by actinic rays.

Direct sunlight for ten hours does not activate olive oil or vegetables.

Vitamin E is known as the anti-sterility vitamin. Its richest source is the wheat germ, so far as science has experimented at the present time. Other sources are corn and oat germs, green leaves contain it; thus we are led to believe that it resides in the chlorophyl or plant pigments, so possibly there is more to color than pleasure of sight.

Olive oil contains vitamin E in a fair abundance; meats and glandular organs to a less extent. It is soluble in ether and is much more stable than any of the other vitamins.

Vitamin E cannot stimulate fertility beyond natural normal limits.

Vitamins and actinic rays tend toward the normal optimum of vigor and health. We may think we need a vacation each summer when in fact we need sunlight much more in winter than a chance to store up a surplus of actinic rays in summer for the coming winter or to replace the insufficient quantity of last winter. Vacation demands are but the instinctive knowledge that we need direct sunlight but how many of us get in the sunlight in a minimum of clothing when we get a chance to take a vacation? The seashore and a minimum of bathing suit is the most ideal place and way to spend a vacation unless we can extend our vacation to many months, then Rollier's idea of sunlight in the high mountains is the equal if not the superior of the seashore. Climate is not all that it is thought to be. Direct sunlight is the thing to be sought and the farther we get from dust and smoke, the more actinic rays

will be able to strike our bodies, hence the more of them we absorb to our very definite advantage.

It may be that the activation of the sterols or the blood stream by actinic rays may start a whole chain of activation through the ductless glands. Who knows?

One thing is certain, most people need more actinic rays than they get and another thing is almost a certainty and that is that the individual who is taking actinic-ray treatments is more likely to resist disease, is more immune, and is happier mentally than if he had not taken them. Actinic rays will not change a personality but they will improve a disposition by improving the digestion and assimilation of the individual.

Sunlight in the mountains gives about 7% of actinic rays against 28% from the quartz-mercury lamps. Sunlight is also limited in time; irradiation from the quartz-mercury lamps can be had night or day whether the sun shines or is hidden by clouds.

Actinic rays and vitamins are at least synergistic and from present evidence can, to some extent, be used interchangeably.

The liver is an important storage organ for vitamin A according to Steenbock and according to Whipple, bile salts are our only true cholagogue.

Hess states that cholesterol when given subcutaneously prevents rickets. He also found that spinach radiated with a quartz mercury lamp retained the activation after boiling for one-half hour.

Dried milk may also be activated by actinic radiation.

Steenbock found that foods radiated for several hours lost the activation they retained the first thirty minutes, an exception being the activated cholesterol. He also found that activated olive oil retained its activation for at least one year.

Cities are fairly well supplied with fresh vegetables and fruits in times of normal transportation although the purchase price is, at times, prohibitive to the poorer classes. The preparation price in personal time and labor is a price most people will not pay, hence we are overfed on carbohydrates and proteins and underfed on fresh milk products, fresh leafy vegetables and fresh fruits. As a nation, we are demanding more relief from manual labor and foods without residue hence we resort more and more to catharsis, to empty the large bowel at times convenient to ourselves and that will avoid disturbing the conventions of civilization. From childhood up, we are first taught and then compelled to abnormal control until natural impulses are suppressed to where stimulation is absolutely necessary regardless of how harmful it may be. Between the times of this artificial stimulation, we carry about with us, and absorbing varying quantities of, putrefactive material which is slowly but surely undermining our health and lowering our normal immunity to disease.

As medical men, we know that many of the diseases we have to treat are the direct result of this slow absorption of toxins self produced, self retained. Wild animals and the wild tribes do not, as a rule, have constipation. They answer at once the natural call for an evacuation of the colon contents, thus they are not afflicted with diseases produced by putrefactive absorption.

It is well known that wild tribes and wild animals very seldom have cancer in any form. While we have no direct proof, is it a wild flight of imagination to assume that our food preservation, our proprieties, and conventions may be very active etiological factors in the production of all forms of cancer?

Remember that all the knowledge we have of contributive etiology is irritations over long periods of time. In short, a very slow cumulative effect of the irritation and remember also that these same irritations are going on in other individuals for like periods of time and much longer in some instances without producing cancer. What is the answer? We do not know, and 2000 years of practical experience with thousands working to solve the riddle, spending millions in their efforts yet we must answer we do not know the etiology of cancer. We do know that the first manifestation is local and if we can remove this local lesion before extensive distant metastasis has occurred, the individual may go through the regular course of life without any return while those with extensive metastasis never get rid of their symptoms much less the invasion of the riotous growth called cancer.

So long as we are unable to find the etiology, so long as we can trace the increase in the number of individuals to "something" occurring in the course of civilization, and so long as it can be traced near its lair in toxic absorption and so long as we can with the aid of our biologists trace food faults in certain diseases to their real etiology and as proof of this may be cited the "deficiency diseases" wherein all that is necessary for the removal of the disease syndrome is to correct the diet, may we not assume that as a preventative of cancer, not its cure, after it has active local manifestations, that the use of the "protective foods" be encouraged?

While we cannot return to the wild habits of evacuating the colon, we can at least make ample provision for the needs of each social center and see that this provision carries with it the sanitation known to be necessary to modern scientists to make the act as wholesome as the conditions of wild life, even if expensive, thus encouraging the populace to answer natural stimulation, meanwhile educating humanity that evacuations are not immodest but are very essential if good health and immunity from disease is to be attained not only from cancer, with all its attendant pain and repulsiveness, but from many other disabilities of civilization, at the same time freeing ourselves of the drug habit either from the patent medicine vender or scientifically prescribed.

So long ago as 1860 Oliver Wendell Holmes put it tersely when he said, "If the whole *materia medica* could be sunk to the bottom of the sea it would be better for mankind and all the worse for the fishes." While we do believe that drugs, surgery, physical therapy in all its phases, have their place in all communities, we do still think that their use is called for too often when a little less strenuous life, a little less of vanity efforts, a little less of enviousness, a little more outdoor exercise, a little more wholesome thinking, a little more judicious selection of our foods, not particularly for their caloric value which is such an indefinite thing in the individual assimilation, but their selection for their protective effect and to encourage natural colonic stimulation, would go far to make the use of drugs, surgery, and physical therapy less needful, thus we would be fulfilling our real function in life's work—that of maintaining the nation's health and consequently its happiness.

Have your patients get their vitamins and minerals in the organic form from fruits and vegetables, not from the chemist. In this way, they get not only vitamins and minerals but roughage which is so badly needed in civilized communities. Many of your cases cannot swing directly from their long established habits of living and eating, and for these it is best to prescribe the fruit and vegetable juices freshly prepared from the fruit or vegetables for immediate use and not purchased preserved from the trades people. Some prepared juices are good and, in emergencies, may be used but they are not the equal and never the superior of those freshly prepared. Among the most valuable of vegetable and fruit juices are tomato, cabbage, cucumber, carrot, beet, melon, onion, grape, apple, pear, persimmon, peach, and citrus fruits as grapefruit, orange, lemon, and lime. These can be given to the most "delicate" stomachs, are palatable, refreshing, restorative, appetizing and strengthening and after a period of their use, one can generally switch to the whole fruit or vegetable with added benefit. So much for the prophylaxis of cancer. For the masses, it is more important than the reparative treatment and the physicians' real place in life is to prevent disease rather than cure it. Preventive medicine is rapidly assuming its place in civilized communities and all physicians should be allied with these movements.

Cancer, as we find it in the early stages, is a local manifestation although there can be no doubt but some kind of a constitutional condition must underlie the local lesion. The chronic observable irritations which are pre-cancer conditions are to be found in a greater number of non-cancer cases than there are cancer cases all told. Now if these chronic observable irritations are a complete etiology, why do not the others develop cancer? In some way, they have at least an immediate immunity.

There are two main types of cancer: carcinomas and sarcomas. Each of these two types are again divided into numerous subdivi-

sions, the end of which has not been reached. Sarcomas are usually found in patients under 40 years of age although they may occur in any age. Of the main types of sarcoma—according to cell form in the order of their increasing severity—are giant-celled, large round-celled, and small round- and spindle-celled. Although all may terminate fatally, we have more control of the giant-celled than of the small-celled. The small spindle-celled or osteogenic sarcomas, particularly the periosteal, metastasize immediately after the growth starts, so there is no time after being seen by the surgeon at which the local manifestations can be separated from the body with any hope of more than palliation. True these cases may be clinically well for one, two, or more years, but all die of sarcoma unless some acute disease or some accident destroys life within a few years. In short this type is always fatal. Some of the giant-celled cases of the epulis type are classed as benign for their complete removal usually means complete relief. Cures, unless three or five years thereafter, are hardly to be talked of with regard to cancer in general and osteogenic sarcomas in particular.

In sarcoma, the exception to this statement is the benign giant-celled sarcoma of the epulis type which does not metastasize and when completely removed does not recur. Enucleation, curettage or amputation may be necessary for its complete removal. If not too far advanced, these tumors respond well to radium.

The spindle- and small round-celled sarcoma may originate in almost any location where there is connective tissue. They infiltrate the surrounding tissues and metastasis occurs through the veins, through the walls of which they may grow without destruction, but once inside the vessel wall they are at once carried to all parts of the body.

Ewing speaking of osteogenic sarcoma says, "Neighboring or distant lymph-nodes usually prove to be purely inflammatory."

The occurrence of pulmonary tumors secondary to periosteal sarcomas was noted by Virchow, but the frequency and extent of such metastatic tumors has lately been emphasized by LeCount. In malignant, cellular, and vascular tumors, pulmonary metastasis often occurs quite early in the disease, so that operation in these cases should not be considered until the condition of the lungs is determined by roentgenograms. These growths occur principally before the twenty-fifth year. Although their principal places of lodgment are in the lungs, liver, and bones, they may lodge in any tissue of the body.

According to Ewing, "The spindle-celled sarcoma represents the purest form of fibroblastic neoplasm," and "When cell-fibrils become prominent and are of adult type, the tumor is relatively benign and deserves the designation fibro-sarcoma." Quoting further from Ewing, "The entire group of primary sarcomatous tumors of bone and bone marrow may be classified as follows: Primary sarcomatous tumors occurring in bone

1. Osteogenic sarcoma ;
 - A. Fibrocellular, chiefly periosteal.
 - B. Telangiectatic, involving marrow cavity, shaft and periosteum.
 - C. Sclerosing, affecting marrow cavity, shaft, and periosteum.
2. Benign giant-celled sarcoma of the epulis type.
3. Myeloma, arising from bone marrow cells.
4. Endothelioma, or angio-endothelioma arising from blood-vessels of the bone or marrow.

"Spindle-celled tumors are the most frequent, and this is the usual form of periosteal growth. The cells have a short spindle form or they appear larger and almost polyhedral, and in very anaplastic processes they are small and appear almost round although never assuming lymphoid characters. Osteogenic sarcoma is never a round-celled tumor. All round-celled growths of bone arise from bone-marrow cells and should be sharply separated from tumors of bone-cells."

Between the benign giant-celled sarcoma of the epulis type, and the very malignant small spindle-celled osteogenic types, there occurs many and various types of sarcoma cells all varying in degrees of malignancy.

As to treatment of sarcomas and bone tumors in general, surgery has failed to give the relief hoped for. Osteogenic sarcomas are practically always fatal although delay may be had for one, two, or more years. Radium or X-ray pushed to the limit of skin tolerance gives better immediate results with less trauma than any other method used today. They are particularly useful in the giant-celled type and give decided relief in the myelomas. Biopsy is still an open question and in our opinion should be avoided when possible.

For detailed pathology of malignant diseases the reader is referred to "Neoplastic Diseases," second edition, by Ewing, and "A Text-book on Pathology," third edition, by MacCallum.

Carcinoma.

The second general classification of cancers is carcinomata. These are mainly differentiated from the connective tissue growing sarcomas by being composed chiefly of epithelial cells surrounded by a vascular stroma. These epithelial cells are of frequent growth among adenomatous or papillomatous cells and possess the ability to grow and reproduce their kind wherever they find lodgment.

They are usually carried in the lymph or blood streams to distant parts of the body although they spread continuously by infiltration of surrounding tissues and this principally along the lymph vessels. While it is not possible to distinguish a single

epithelial cancer cell from a single normal epithelial cell, it is comparatively easy to separate normal epithelial tissue from malignant epithelial tissue by the difference in arrangement of the tissue cells. To quote from MacCallum, "We may distinguish the following groups of carcinomata;

"1. *Squamous or Flat celled cancers*. These arise in the skin, oesophagus, etc., or wherever there is stratified epithelium, and are commonly known as epitheliomata.

"2. *Basal cell cancers*. These arise chiefly in the skin, but analogous tumors are found elsewhere. They are relatively non-malignant and are the basis of the so-called *rodent ulcers*.

"3. *Cylindrical cell cancers*. These are analogous to the polyps or polypoid adenomata or mucosae which have glands lined with columnar epithelium. They retain the tendency to form gland-like structures lined with cylindrical epithelium and are hence called *adeno-carcinomata*.

"4. *Cancers derived from Acinous glands*. These are analogous to the solid adenomata and are the commonest cancers since they include the cancers of the breast. In them the epithelium grows in solid strands. No very appropriate name has been given them and none is in common use. They are gland-cell cancers so non-committal in appearance as not to suggest a definite morphologically descriptive name."

Carcinomata are usually found in those past forty years of age although the past generations have seen this age limit lowered to thirty and well down in the twenties. We have had two breast carcinomata in women at twenty-six and twenty-eight years of age respectively and one cancer of the cervix at twenty-six years of age. One cancer of the stomach at twenty-three years of age. One case of epithelioma of the rectum was reported as having occurred at eleven years of age.

In carcinoma increasing age is a factor, which must not be forgotten, but which alone is not sufficient to call it a fundamental etiological factor. Something underlies this age factor and that something has not been determined.

Squamous-celled epitheliomata are the most malignant and are the hardest to deal with therapeutically. These are most frequently found growing in mucous membranes in various parts of the body or upon the skin surface. As seen upon the lip, they may be taken as characteristic of this group. The first sign is the scaling of a small spot on the mucous surface without underlying induration. If this scaling continues and the lesion increases in depth, a drop of blood may follow its removal and about this time a slight induration is possible of discernment on palpation. As the condition increases, an ulcer forms which recrusters as often as they are removed with no tendency to heal and if this ulcer is allowed to progress, metastasis will make its appearance first in the submental

region, later in the submaxillary and cervical regions. The first enlargement of the lymph glands draining these ulcers is due to absorbed infection, therefore the enlargement is due to inflammatory changes. If, however, the ulcer is allowed to grow, the lymph gland succumbs to the constant drainage and becomes malignant. At this time the metastasis has carried cells to various parts of the body and the prognosis is fatal. Operative work, radium, nor X-ray seem of any avail after the lymph glands become necrosed from malignancy. The distant metastasis from the cavity of the mouth and lower part of the face is usually first into the liver and thorax.

In the mouth or upon mucous membranes anywhere in the body the same changes take place as upon the lip except that the scaling is constantly macerated showing first an erosion, later induration, and ulceration followed by metastasis first to the glands draining the involved area later to distant parts of the body.

In the urinary bladder, epitheliomata frequently start in papillomas which they invade or as stated by MacCallum "are probably from the beginning malignant in character and merely impose themselves for a time as benign growths." Other bladder epitheliomata are erosive and ulcerative from the start, while others are infiltrative from the prostate gland in the male and the uterus, vagina, or urethra in the female.

Cancer of the prostate gland starts as a hard nodule. This is followed by other nodules all of which become stony hard and gradually fill the pelvis. When they spread to the bladder mucosa they may produce ulceration and hemorrhage. Among the first symptoms produced are pain in or throughout the pelvis, sacrum, or lower lumbar region and down the legs. Frequently these leg pains are diagnosed as "Sciatica." At this stage which is late and accompanied by metastasis, there is usually an accompanying cachexia.

Among the most important squamous-celled epitheliomata after those of the mouth are those of the cervix uteri. Here they usually start on the vaginal side of the cervix. Those well within the cervix are usually adeno-carcinomatous. Being well enclosed against any but specific observation they are usually well-developed ulcerations when first seen and the symptom which usually brings the patient for examination is not the serous discharge, which is so common in women, but that it is mixed with blood or else there is definite bleeding. The direct lymph drainage from the cervix is into the broad ligaments and as this area is well supplied with lymph vessels, metastasis is early which explains why so many of these cases have fatal endings. When first seen by the surgeon the base of the broad ligament and surrounding vital structures are usually freely infiltrated with epithelial cells which cannot be removed, hence the frequent last resort to radium and X-ray.

The growing consensus of opinion is that radium and X-ray should be used at the earliest possible moment without operative

procedure. In this way outlying cells can be reached and with some hope of their complete eradication. As stated in the preface, no attempt is being made toward completeness but as squamous-celled carcinomata are very similar regardless of the tissue of the body in which they may be located, their treatment varies more from locality of lesion than from tissue involvement or from any difference in cell arrangement.

Surface lesions are more easily eradicated because first they metastasize less, and second it is easier to reach them than the lesions located within the cavities of the body.

Squamous-celled carcinomata of the skin usually show keratosis as their first evidence of tissue change. This may go on for years before there is any breaking down of the deeper layers. However, that should not permit of any delay in the removal of the apparently simple keratosis for it is definitely pre-malignant. The later changes in the skin are similar to those occurring on the lip except that there is less metastasis and it is slower in starting but is just as definite if given sufficient time.

Basal-celled carcinomata are derived from the lower layer of the skin, are usually found upon the upper half of the face, and forehead, and infrequently upon other parts of the body. They start as nodules in the deep layer which pushes the outer layer of the skin forward as they grow. They are, therefore, first palpable, later visible, and if allowed to grow, finally break down, forming ulcers with thickened, roughened, overlapping edges differentiated from lupus which has a rolled smooth edge and usually healed on one side, spreading on the opposite side. They differentiate themselves from the squamous type of epithelioma by having no tendency to form either keratosis or pearls.

It is in the ulcerating stage that they are, many times, denominated rodent ulcers. They are very chronic but persistently ulcerate if not treated. They are usually easily healed as they do not tend to metastasize nor to recur if thoroughly removed.

Treatment. The basal-celled types are best removed by desiccation if small or electrocoagulation if large unless they are situated on the eyelids, when it may be advisable to use radium. If radium is used, it should be a fairly heavy dose at first as repeated treatments seem to devitalize the surrounding cells and prevent healing; then one must resort to electrocoagulation. If small, a local anesthetic is all that is necessary. If large, a general anesthetic should be used, hyoscin and morphin being the anesthetic of choice.

Adeno-carcinomas are found wherever there are cylindrical cells as in the mucous membrane of the digestive tract, in the mammae, in the body of the uterus, in the prostate gland, tonsils, and bronchi. They frequently start as a simple adenomatous hypertrophy which is frequently followed by changes which are distinctly carcinomatous. This is the type of carcinoma usually found in the

mmae. The tendency is to metastasize early into adjacent axillary lymph glands and from thence to the supra- and infra-clavicular and cervical glands, later into those in the mediastinum. From the breast, metastasis very frequently occurs in the spine, upper third of the femurs and pelvic bones. It may likewise occur in the liver, by direct metastasis through the lymphatics from the lower quadrants of the right breast indirectly through the lymph and blood streams. The lungs may, likewise, become involved.

Other types of carcinoma found in the breast are, according to MacCallum:

"1. *Tumors of stratified epithelium* which are either those beginning in an eczema-like alteration of the nipple and adjacent skin (Paget's Disease) or those which arise in the substance of the breast and are, nevertheless, composed of squamous epithelium (Troell and others).

"2. *Tumors Derived from the Cells of the Acini of the Gland.* These may be made up of abundant ramifying masses of cuboidal cells, with relatively little stroma, so that great soft cellular masses are formed (medullary cancer), or there may be less abundant cell strands, with a relatively greater amount of stroma, so that the tumor area is composed of firm whitish tissue, or finally the epithelial structures may be greatly reduced, so that only small groups and their strands of cells are formed embedded in a dense, scar-like mass of fibrous tissue (Scirrhus cancer).

"3. *Tumors Derived From the Ducts and Their Branches.* These approach more nearly the cylindrical cell cancer, and are often in the form of tumor masses made up largely of tubular epithelial structures. There are usually cysts associated with this form, and these may have a thick lining of several layers of cells. There is another type, of relatively benign character, in which every section shows canals or cavities lined with a thick layer of many rows of irregular cells. These have been called adeno-carcinoma by Halstead, and have also been referred to as comedo cancers, on account of the fact that cells can be squeezed out like the material from a comedo or blackhead in the skin.

"4. *Colloid Tumors.* Tumors derived from the epithelium of the acini but presenting an extraordinary colloid or gelatinous metamorphosis of the stroma. Of these, the most important by far are those derived from the cells of the acini. The tumor appears as a hard nodule in the substance of the breast, and later often forms adhesions with the skin or causes a retraction of the nipple. The extension to the skin may be followed by ulceration."

These must be differentiated particularly from benign adenoma and fibroma, also from chronic cystic mastitis. In a general way by palpation, the adenomas are soft or spongy, which is also true of the medullary type of carcinoma, and this type should be removed at once for microscopic examination by a competent path-

ologist for, as already stated, the medullary type metastasizes almost immediately with the beginning of the growth. The fibromas, on the other hand, are hard, many times multiple and usually movable, therefore not adherent. The cystic usually occurs at a later age than the two other types and gives a sense of fluctuation unless very tense then more like that of fibroma. The fibromas usually occur in the twenties or early thirties, the adenomas during the thirties, the carcinomas during the forties and fifties, and the chronic cystic mastitis at later ages and these have a marked tendency to become carcinomatous.

The scirrhous types of acinus tumors metastasize very slowly and may exist locally for many years, yet Bloodgood found, by statistical studies, that "these cases are persistent and finally fatal."

Colloid tumors of the breast are relatively benign and do not tend to metastasize.

Hydatid moles and chorionic epitheliomata are two uterine conditions occurring during or soon after pregnancy. The hydatid mole many times grows instead of the embryo, at other times it forms a part of the placenta. It is usually benign and although it may occur during several successive pregnancies only occasionally does it become carcinomatous. *The chorionic epithelioma*, on the other hand, is usually very malignant although a few cases have not recurred following extensive curettage or total hysterectomy. The chorionic epitheliomata may form during pregnancy producing hemorrhages not wholly unlike those occurring with placenta praevia, from which it must be differentiated. However, it is usually not until several months after confinement that the first symptoms appear as frequent, severe hemorrhages. And it is for the relief of these that curettage is performed and a specimen obtained for microscopical study that reveals the real diagnosis of the condition. Metastasis is common and usually into the lungs or brain. Chorionic epithelioma is really an exaggeration of the normal chorionic invasion of the uterine muscle during pregnancy but, like other epitheliomata, no explanation is vouchsafed why in most cases following pregnancy, there is a return of the uterus to normal and in a few there is a riotous mob of lawless cells.

Treatment. The treatment of the various types of cancer varies with the location, the stage of its existence, the age of the patient, and the type of lesion. For the basal- and squamous-celled types where the lesion is small and particularly if it is on the face or hands, desiccation with the unipolar (Oudin) current, following local anesthesia, using about one-fourth inch spark, is usually about all that is necessary. If the lesion is large or near important structures or large nerves, use the bipolar (d'Arsonval) current, which is more destructive and requires more care in its use. It can be used with a local anesthetic, although usually when it is

the current of choice a general anesthetic is required. With the d'Arsonval current, one can either desiccate, coagulate, or carbonize the tissue at will. Here from 100 to 2500 milliamperes are used according to the requirements of the case. Enough should be used to entirely destroy the growth, after which it may be removed with curette or cutting instruments. This method was developed in the United States by William L. Clark, M. D., Philadelphia, Pennsylvania, following Doyen of Paris, who used large electrodes. Dr. Clark uses needle electrodes which give a finer control and a greater adaptability of the method. Others have followed his leadership.

This method is applicable to most surface lesions as well as most lesions within the mouth, vagina, or rectum and should be followed by radium in various forms of applicators to suit the tissues surrounding the lesion. The post-operative use of radium or X-ray is advisable for the destruction of the outlying cells which may not have been reached by the heat produced in the tissues by resistance to the passage of the current. X-rays are more suitable for widespread metastases.

For cancer of the thorax and abdomen, various operative measures are used although most of these cases are too far advanced when diagnosed to hope to obtain more than palliative relief.

Cancer of the breast is best treated by complete removal by block dissection of the mammary gland, surrounding involved muscle tissues, and the axillary fat and lymph bearing tissue.

I prefer doing this by the electric cautery methods of J. F. Percy, M. D. My reasons for so doing are that it requires a minimum of time, is almost bloodless, requires no crushing of tissue with hemostats or clamps, reduces shock by shortening the operative time, and lessens the quantity of blood lost. This method diminishes the post-operative toxic absorption by closing, absolutely, the lymph and blood vessels, thus stopping possible metastasis during or immediately after the operation and by diminishing the possibility of implantation during the operation. There is no afterpain and the healing is by first intention. With this method, these patients are usually out of bed by the fourth day. I have them use the arm as much as possible immediately upon recovery from the anesthesia and they are usually able to feed themselves with the hand on the operated side by the third or fourth day.

By making the incision along the anterior margin of the deltoid and the outer margin of the pectoralis major muscles, the axilla will be scar free, which allows almost full normal movement after healing.

The general anesthesia I use is described under the heading of "Twilight Sleep." In these cases, the operative work and the use of radium are followed by general treatments of actinic rays given daily for their relief of stasis and to destroy any possible infec-



Basal-celled carcinoma.



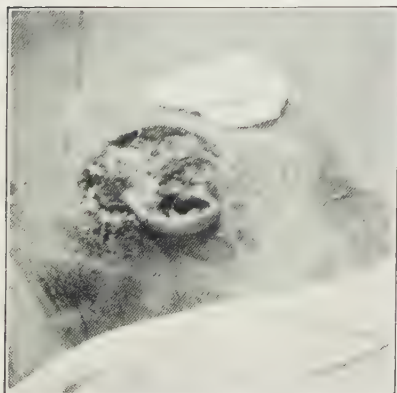
After result.



Basal-celled carcinoma.



After result.



Squamous-celled carcinoma.



Appearance three months later.



Squamous-celled carcinoma.



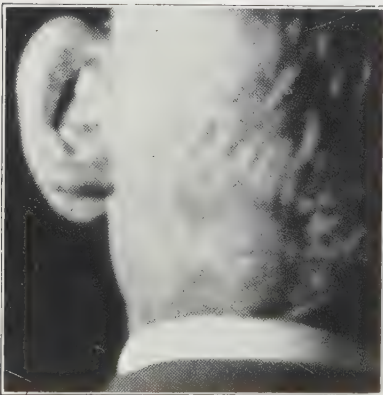
Appearance two years later.



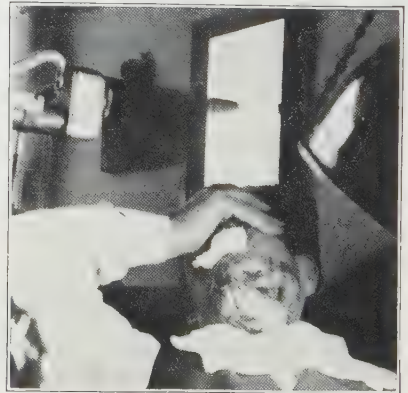
Basal-celled carcinoma.



Basal-celled carcinoma.



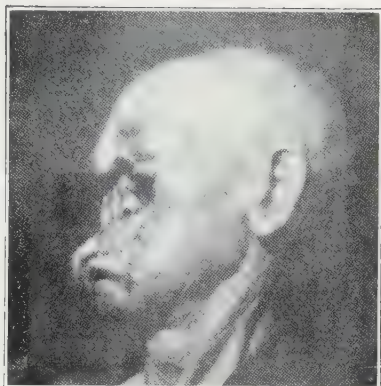
Basal-celled carcinoma.



Metastasis from squamous-celled carcinoma of the tongue.



Carcinoma eighteen years'
standing. Front view.



Lateral view.



Carcinoma of the upper lip and
alveolar process.



Showing minimum of scar.



Basal-celled carcinoma of nose.



Result three months later.



Adeno-sarcoma of testicle. Gross section.

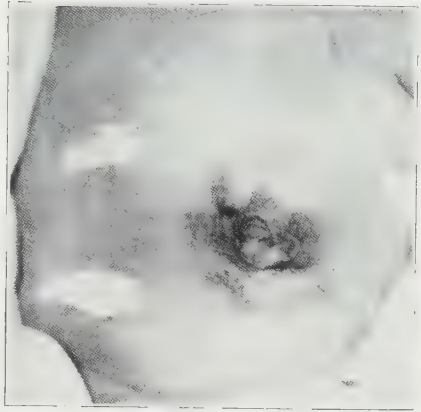


Gross section of upper picture as removed by cautery.

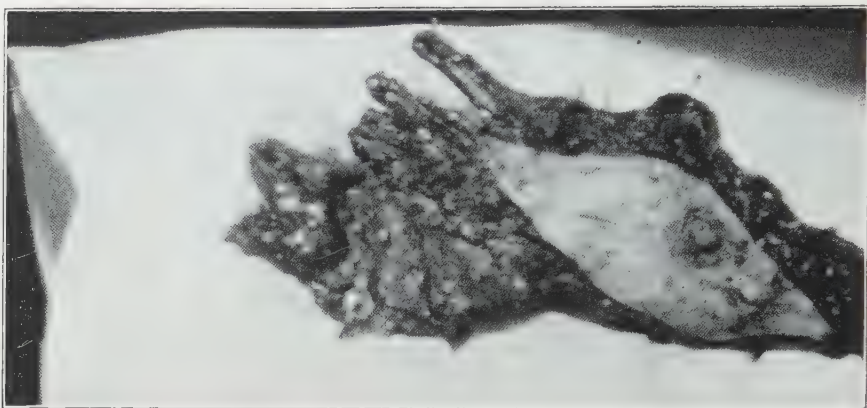


Roentgen-ray burns twenty-two years old.

Carcinoma of male breast metastasized from finger opposite.



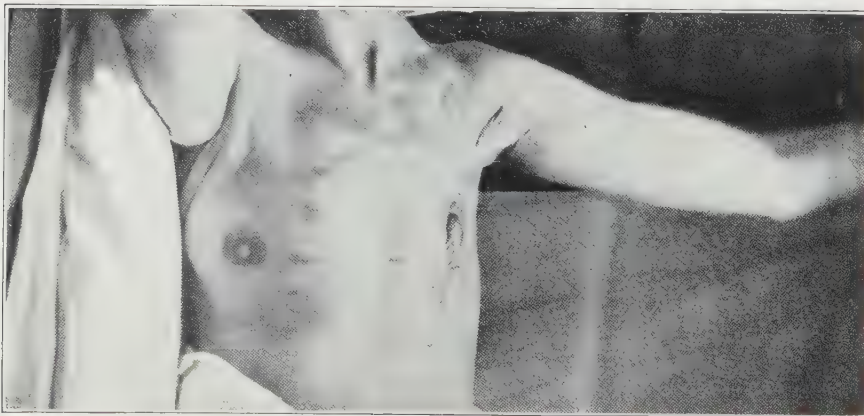
Appearance two months after treatment with Oudin current and actinic rays.



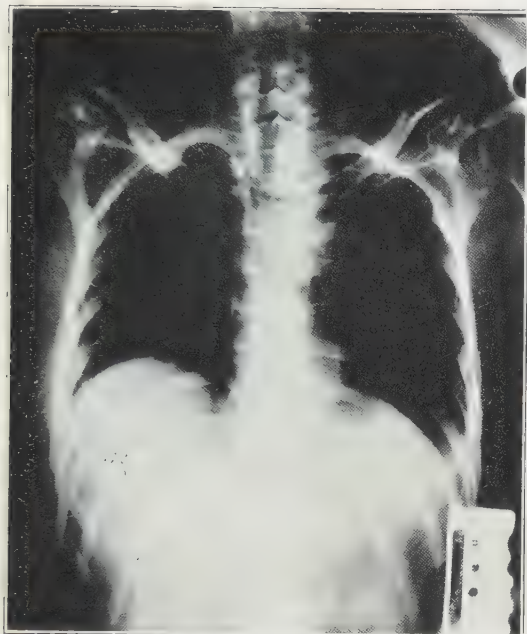
Block dissection of breast and axillary contents with Percy cautery.



Appearance immediately after operation.



Appearance two weeks later showing freedom of motion.



Carcinoma of upper dorsal
vertebrae. Metastatic from
right breast.

Same case as above
metastatic to lumbar ver-
tebrae, pelvis, and upper
third of femur.





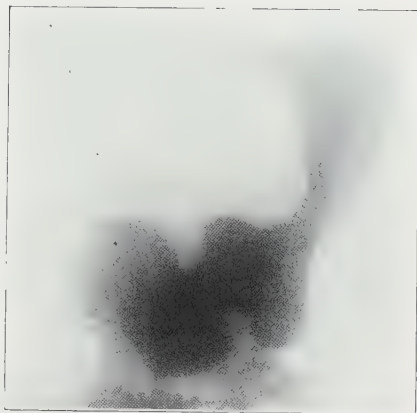
Carcinoma of the esophagus.

Roentgenogram taken three months
later after radium treatment.





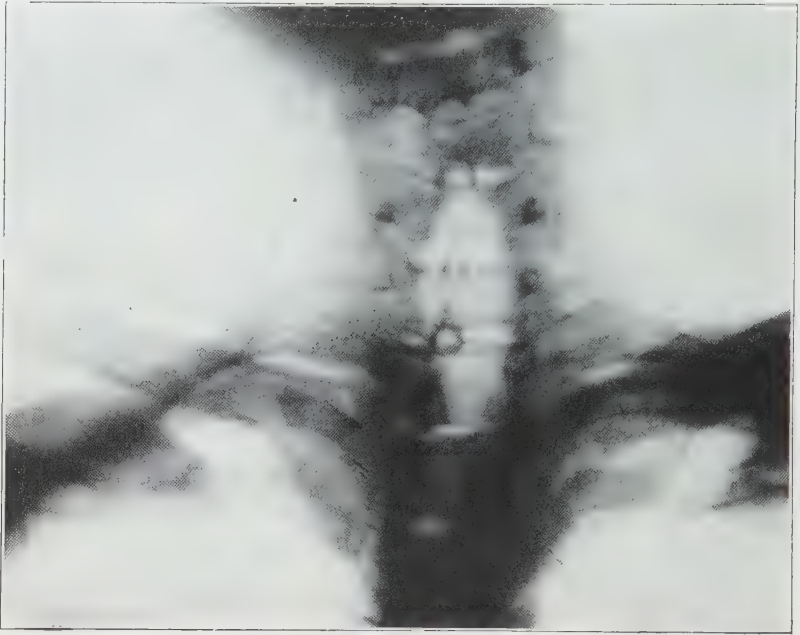
Carcinoma of the lesser curvature
of the stomach and pylorus.



Carcinoma of cardiac end
of stomach.



Carcinoma of the greater curvature of stomach and pylorus.



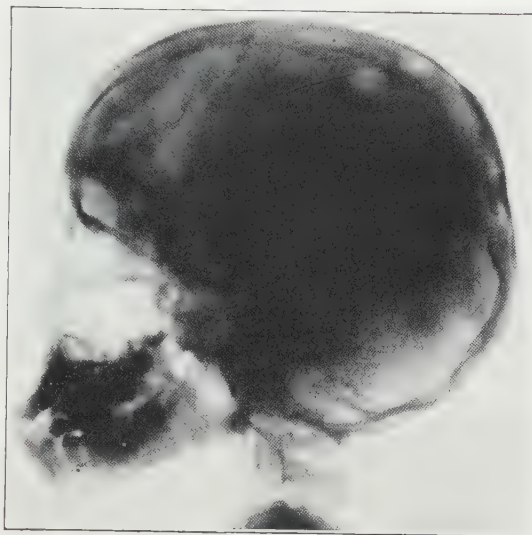
Carcinoma of cervical vertebrae. Metastatic from larynx.



Carcinoma of lower maxilla.



Sarcoma of face.



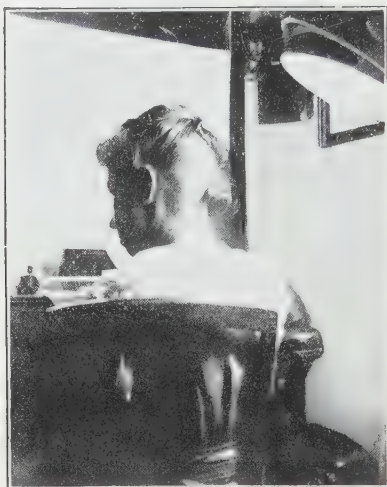
Same case showing metastasis to skull.



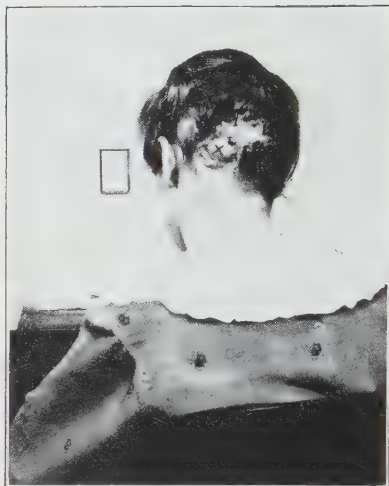
Sarcoma of ethmoid spreading to nose and antrum.



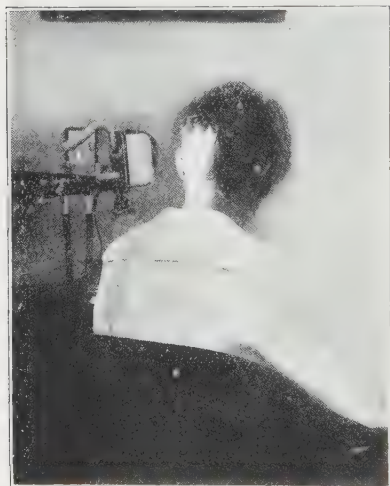
Roentgenogram of same.



Appearance when patient came to us.



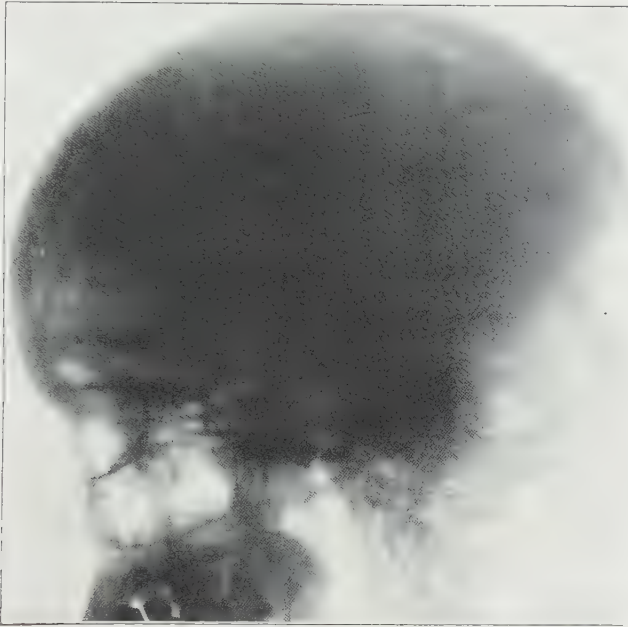
The "x" shows the exposed brain tissue, above which is the cauterized area.



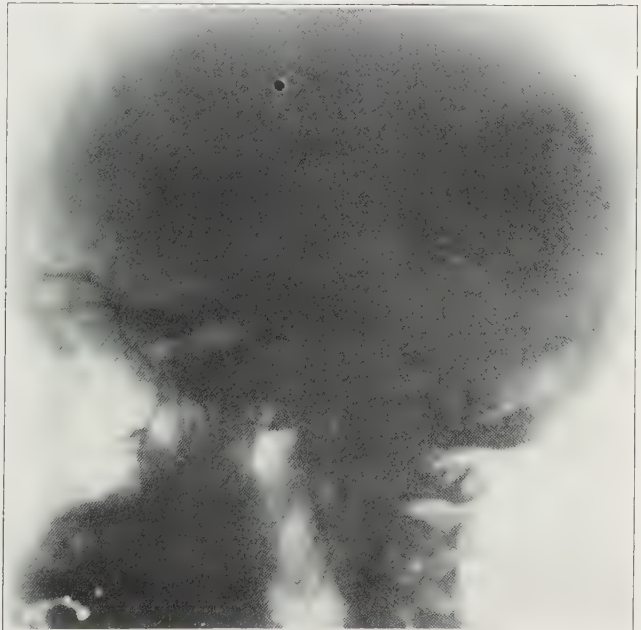
Showing position of water-cooled lamp when treating granulating wounds. Wound nearly healed.



The "x" shows same area as in picture above. Wound healed.



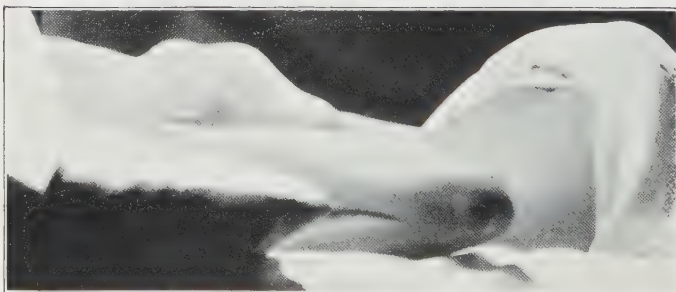
Roentgenogram of Plate XXXVIII.



Same case as above.



Primary sarcoma of head of femur.



Spindle-celled sarcoma of scapula.

Melanoma of great toe with metastasis
to inguinal glands.





Primary periosteal sarcoma of tibia and fibula.

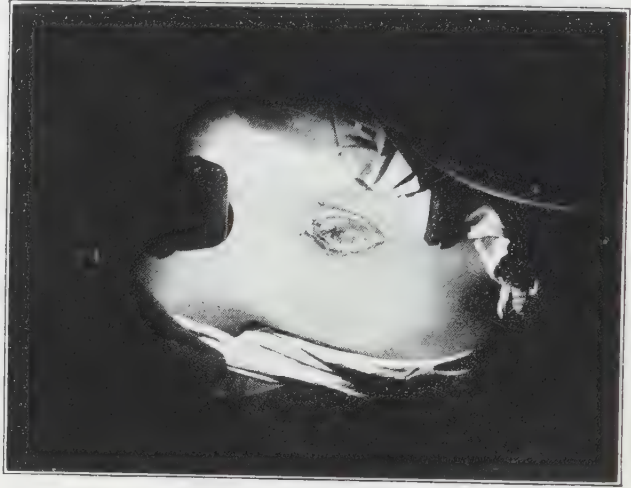


Metastasis to lung one year later.

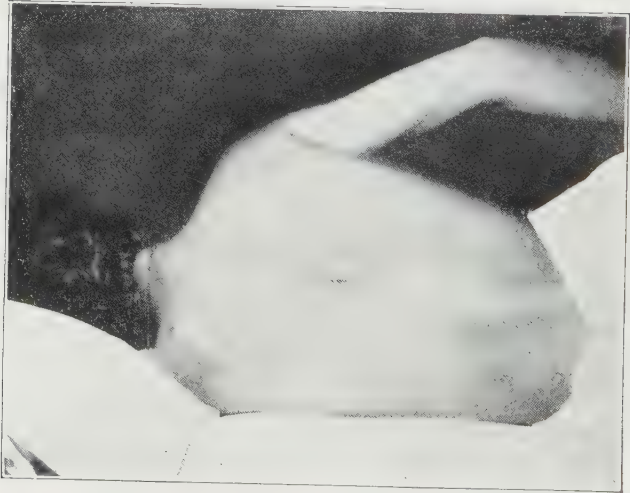


Showing growth three weeks after second roentgenogram.

Fibrosarcoma



Showing wound one week after operation.



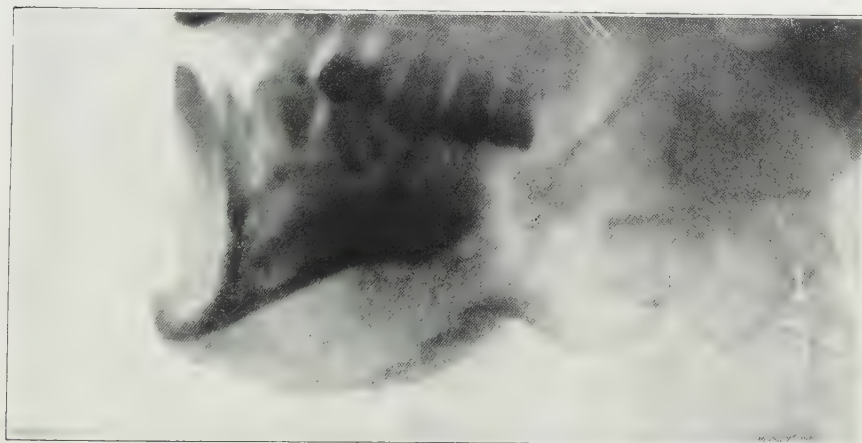
Showing scar as it appeared eighty-one days after operation.



Multiple myeloma of femur
and tibia.



Same case—lower tibia and foot.



Same case as above—lower maxilla.



Pieces of bone destroyed by electrocoagulation. Removed three months later.

tion, also for their general metabolic action and for their restorative action on the accompanying anemia. In no sense are the rays from the quartz mercury-vapor lamps used to destroy the cancer cells. This must be done by more active agents.

Case 99 B. Male, age 39. Was referred to me May 29, 1921. The history showed that a mass had been noticed in the epigastric region six months previous. Exploratory laparotomy revealed that this mass was in the greater curvature of the stomach. It was about six inches in diameter.

His blood count June 9, 1921, was:

Hemoglobin	15%
Erythrocytes	1,472,000
Leucocytes	2400
Polymorphonuclears	61%
Small lymphocytes.....	24%
Large lymphocytes.....	10%

He was bedridden and suffered from severe dyspnea.

He was given general visible-light and actinic-ray treatments daily.

On June 15, 1921, his blood count showed:

Hemoglobin	25%
Erythrocytes	2,650,000
Leucocytes	4200

On July 9, 1921:

Hemoglobin	40%
Erythrocytes	3,900,000
Leucocytes	7400
Polymorphonuclears	59%
Small lymphocytes.....	20%
Large lymphocytes.....	18%

The above count was taken just three days before his death but shows the influence of the visible light and actinic rays upon the blood stream, notwithstanding there was a rapidly growing carcinoma of the stomach.

DIAGNOSIS: Advanced Carcinoma of the Stomach.

Carbuncle.

A *carbuncle* differs from an ordinary boil in that it spreads throughout the tissues and does not have a definite core. The average diameter is about two inches, although it may include the entire posterior cervical region and include all tissues from the skin to the deep cervical fascia.

Carbuncles are usually found in the posterior cervical region, but may be found in the scalp, lips, or other portions of the body. They are frequently associated with diabetes.

Their symptoms are those of the ordinary boil, except that they spread more rapidly and involve a larger area, with softening throughout the inflamed area.

Their cardinal symptoms are those of the infection from other sources, plus the infiltration in the surrounding tissues, and their lack of core. The surface has honey-combed openings in place of draining from one or two points. If the involved area is large there will be chills and fever, the temperature often running up to 103° or 104° F. The duration varies from a few weeks to months and if permitted to progress or if untreated may be fatal.

The prognosis is very grave in the very old or in those afflicted with advanced nephritis or diabetes mellitus.

Carbuncles must be differentiated from the ordinary small boil, or furuncle, and anthrax.

The general management requires cleanliness, a lack of movement of the head, although not necessarily rest in bed or even at home. The diet should be liberal but not excessive.

The physical therapeutic modalities usually required will be visible light and actinic rays. The d'Arsonval current is valuable in severe cases for the actual destruction of the infected area and with these antiseptics will seldom be needed. Irritant antiseptics should not be used.

Magnesium sulphate, one ounce to a pint of water, makes a splendid wet dressing which can be used hot, cold or at room temperature.

If seen early, the treatment will be actinic rays from the water-cooled lamp for one to three minutes at a distance of one-half inch and usually this will be all that is required. However, if the case has advanced for two or three weeks or more it may be necessary to use the d'Arsonval current for the destruction of the involved area. This will leave a clean granulating surface, which should then be treated with actinic rays from the water-cooled lamp at about one inch for one minute daily until the wound is well contracted, then less frequently.

If the area is very large, in addition to this the patient should have general visible light for about ten minutes each surface treated, and actinic rays for about one minute, increasing one minute daily until a period of ten minutes is reached.

The average length of time required for treatment for the early cases will be from one day to one week, for later cases from one week to one month or more if the granulating surface is large.

Case No. 265. Male, age 38. On August 15, 1924, he noticed a lump on the posterior surface of his neck which had grown steadily worse in spite of treatment. On August 25, 1924, when he came to us, he had an open sore the size of a silver dollar which exuded pus as from a sponge.

His first treatment was with the water-cooled lamp for two

minutes. August 26th, the water-cooled lamp was used for four minutes. August 27th the slough was removed and the water-cooled lamp used for two minutes and the same period of time on August 28th. On August 29th the light was given for two minutes and aluminum acetate 1% was used as a wet dressing, which was repeated August 30th, at which time the wound was closing rapidly.

Sodium iodide 32 grains and guaiacol $\frac{3}{4}$ of a grain were given intravenously with each of the above treatments.

DIAGNOSIS: Carbuncle.

Caruncle.

Caruncles are small red papillary growths at, in, or around the external urinary meatus of women. They usually occur after middle life. They are composed of small blood vessels and nerve filaments, hence their tendency to bleed and the reason for the pain which frequently accompanies them.

They are benign, chronic, and removable. Their objective symptom is their appearance described above. Their subjective symptoms are discomfort or pain particularly on urinating and occasionally bleeding.

Their treatment is complete removal either by surgery, electrocoagulation, or radium.

The prognosis is good.

Case No. 171. Female, age 63. Was referred June, 1924. Examination showed a red, painful mass surrounding the external meatus and protruding therefrom. The pain was particularly severe on palpation and when urinating.

Her treatment consisted of destruction of the growth and about the external one-fourth of the urethra by electrocoagulation under an anesthesia of morphine $\frac{1}{4}$ grain, hyoscin 1/100 and novocain 2%, used locally. The next day she was free from pain on urinating and this freedom continued. The slough came out the tenth day and there was complete healing in three weeks.

DIAGNOSIS: Caruncle.

Catarrh.

The term catarrh usually means a mucus discharge from a mucous membrane and usually that from the nose or its accessory cavities. This may be either acute or chronic. The acute type is known as a "cold in the head" while the chronic type may be a sinus infection from any of the accessory sinuses or upper air-passages or it may be an ozena or actual destructive process of the mucous membrane of the septum, the turbinates, or surrounding the bony frame work as in syphilis.

The *etiology* usually is that of repeated colds or local infection of the nasal mucous membrane extending from this point to the accessory sinuses. Irritants, either chemical or physical, and larvae

from flies or insects are at times the etiological factors. Examination should be made for polypi or other nasal growths.

The bacteria found most often in catarrhal conditions are micrococcus catarrhalis, which must be differentiated from meningococcus, or staphylococcus albus.

The pathology is either a simple inflammation or a destructive atrophy due to inflammation.

The cardinal symptom is a nasal discharge which may be of any consistency from a watery discharge to a thick, stringy, glutinous, yellow discharge. With acute catarrh, there is little or no odor. The odor is very intense with the chronic catarrh, especially of the ozena type.

The laboratory finding of various bacteria will be by smears and cultures.

The diagnosis and the differential diagnosis will depend upon the area involved, the color of the mucous membrane, the destructive process found, and the finding of the etiological bacteria.

Syphilis is known to cause an atrophic condition of the mucous membrane with destruction and perforation of the membranes and bones in the nose and the accessory sinuses. Diphtheria also tends to produce a condition which may be anything from a membranous irritation in the nose to a membrane filling both nostrils and sinuses and it must be remembered that it has a characteristic musty odor.

The general management of the case will consist of cleanliness of the cavities by suction or irrigation and here a three per cent solution of magnesium sulphate answers every purpose. At times it will be necessary to use a mild antiseptic as argyrol, five to twenty-five per cent, or mercurochrome, one or two per cent solution. Nasal packs of argyrol, ten per cent, are at times of value.

In the chronic cases it will be necessary to keep the general health at the highest vantage point possible by out-of-door exercise and sleeping in the open air or with the windows of the bedroom opened wide. Adequate rest and sleeping hours as well as a diet of fruits, vegetables, and whole grains, if possible, should be insisted upon.

Therapeutic methods advisable are surgical treatment which may at times be necessary to remove exostoses, enlarged turbinates, polypi, or for a deviated septum, but the principal treatment should be visible light over the face at a comfortable distance for about one-half to one hour, actinic rays from a water-cooled lamp thrown into each nostril through a quartz or tubular applicator for from one to three minutes. The pharynx, larynx, and tonsillar areas should be treated with the water-cooled lamp from one to two minutes through an open tube applicator in order to destroy any infection which may have extended from the nares. These treatments should be given daily until there is definite improvement, then two or three times a week.

If the disease is syphilitic, it will require intravenous injections of anti-syphilitic remedies. For the ordinary infections, intravenous injections of sodium iodide and guaiacol (32 grains of the former and $\frac{3}{4}$ of a grain of the latter) will be found extremely useful. For local application, a ten per cent solution of oleum terebinthinae in oleum olivae will be of decided advantage.

The average length of time these cases will require treatment will be from three to ten days for the acute diseases, and from weeks to months for the chronic cases, depending upon the etiology.

The prognosis of these cases is good with the exception of the advanced cases of syphilis, where it should be guarded.

Cavernositis.

The etiology is somewhat obscure. Different writers on the subject include traumatism, gonorrhea, syphilis, arthritis, tuberculosis, and diabetes, which seem to be fairly common accompaniments. Mild traumatisms and a chronic low grade infection are the most probable etiological factors. While cases occur in young adult life, the majority occur around fifty years of age.

The pathology is a chronic inflammation of the fibrous sheath surrounding the corpora cavernosa, producing a thickening and induration of the same, with frequent nodular areas. The induration extends into the interspaces preventing dilatation with consequent curvature. There is no interference with the nutritional blood supply to the penis, but as the interspaces contract and fill with fibrous connective tissue they cannot dilate and properly fill during sexual excitement, hence the curvature which is usually upward if both corpora are equally involved or laterally if only one is involved. Even in well advanced cases, there is but slight deformity when the organ is flaccid. Calcareous deposits are possible during the healing stage. The condition is benign.

Differential diagnosis will be from fibroma, enchondroma, osteoma, sarcoma of the penis (very rare), and carcinoma which is painful, inflammatory, metastasizes rapidly, and becomes adherent to the skin, all of which fibrositis never does.

Fibrositis must also be differentiated from phlebitis which is an acute inflammation with edema. Urethral indurations are in the spongiosum and therefore easily differentiated. Gummata are easily influenced by antiluetic treatment. Chordee has a curvature but is strictly an acute condition and accompanies an anterior urethritis, so there should not be any difficulty in differentiating it from a fibrositis.

Symptoms. There are few subjective symptoms except mental. There may be some discomfort on palpation and occasionally in advanced cases during erection. The objective symptoms are a slight depression at the point of fibrosis during the flaccid state and an upward or lateral curvature during erection. Palpation re-

veals induration of the corpora, which is almost invariably on the dorsal surface. The one complaint of all of these cases is the inability to copulate because of the curvature during erection. This disability will increase with the fibrosis. Irritability and various neurasthenic symptoms are mental states which develop with the disease.

Treatment. Under general care there is nothing to do that is of any avail, neither are drugs. Thiosinamin injections have failed. Sodium chloride ionization does not seem to relieve. Surgery has proved of value when the fibrosed area could be entirely removed. X-ray is of value but hard to administer because of the liability of sterilization. Radium is of distinct value and with its use the testicles can be protected. Radium should be used in stimulative doses, never as a destructive agent. Diathermy is of some value early and after operation.

Prognosis. The prognosis is fair as to relief. Recurrence is the rule. The disease is never fatal.

Case No. 221. Male, age 57. Came to us on September 15, 1921, and gave the following history: Three months ago noticed that there was an upward curve to the penis, particularly noticeable when erect, at which time it was painful. The condition had become more pronounced the past month. Physical examination showed a hard, fibrous mass lying lengthwise on the dorsum of the penis and about two inches from the pubes, in size about one inch in length and one-half inch in breadth and thickness, not tender to touch and neither red nor swollen.

He was given an application of 75 milligrams of radium for one hour, consisting of one pack screened with one millimeter of lead, one millimeter of rubber, and one-half millimeter of brass. Following this treatment he had twenty diathermy treatments covering a period of three months each of 300 milliamperes for thirty minutes. The electrodes used were composition metal of about $1 \times 1\frac{1}{2}$ inches, which heated not only the involved area but the surrounding area as well. His improvement was steady and at the termination of the treatments there was less curvature, a smaller fibrous mass, and no pain.

DIAGNOSIS: Cavernositis, fibrous.

Cellulitis.

Cellulitis is an inflammation of the submucous or sub-dermal tissues. In the pelvis, it is usually following infection from the vagina through the cervix and cervical tissues into the broad ligaments and is usually carried there by the lymph system or through the uterus into the tubes and thus into the general pelvic cavity.

It is caused by the closing of the lymph drainage by infection or trauma, thereby throwing the lymph into the cellular tissues,

thus producing a lymph-edema. This lymph-edema is also the protective zone thrown out to limit the spread of infection either by phagocytosis or by the formation of adhesions which, at the same time, limit motion and movement-massage.

While these adhesions are primarily life savers, secondarily they may become so heavy that they limit motion of joints or function of organs. In the first instance, they must not be molested until their protective action is no longer needed, while in the second instance treatment must be directed toward their removal. The same condition may occur beneath the skin on the external surface of the body and is due to the same etiology.

The pathology is edema of the sub-mucous or sub-dermal tissues, which when infected causes abscess formation and may be followed by septicemia or pyemia.

The cardinal symptom is localized edema. The usual symptoms in addition to edema are pain, inflammation, abscess formation, and destruction or adhesion of the surrounding tissues.

There is no blood picture, except that of infection, which means a hyperleucocytosis usually from 15,000 to 30,000. Of this number, from 70% to 85% will be polymorphonuclears if the fighting ability of the tissues is at par. The lower the polymorphonuclear percentage, the graver the prognosis. Symptoms appear rapidly, sometimes taking only a few hours to produce an edema sufficient to compress the tissues to the point of food exclusion.

It must be differentiated from pelvic peritonitis, which is deeper than the cellulitis, from erysipelas and from chemical or thermal actions, which are superficial and short of actual necrosis.

The general management of the case will consist of rest of the infected parts, a mild non-stimulative diet, and as good hygienic surroundings as the condition of the patient will permit.

The therapeutic modalities advisable in pelvic cellulitis are continuous hot douches at a temperature of 120° F., for which a continuous douche syringe must be used, for the skin will not tolerate a temperature above 115° F. These douches should be continued for three or four hours, discontinued for one hour, and repeated until relief and definite improvement occur. This furnishes the best form of localized heat, although during the intermission an infra-red applicator may be used to continue the heat. The infra-red rays penetrate the tissues more deeply than the conductive heat from the hot water. These local treatments may be followed advantageously by the use of cotton or wool tampons, saturated with a solution of magnesium sulphate in glycerine (magnesium sulphate, saturated solution, 25% in glycerine).

The next best form of heat is the general visible-light for prolonged periods of time, followed by actinic rays, both local and general. If the visible light is used, it should be continuously or

nearly so over the lower abdomen and pelvis at a distance comfortable to the patient. These treatments should be given daily until there is definite relief and then less frequently.

Surgical treatment for drainage will be necessary with the formation of pus. Simple vaginal drainage with gauze or rubber tubes will usually be sufficient. After drainage these cases should be treated vaginally with actinic rays from a water-cooled lamp given through a bivalve speculum. In addition, give general visible-light and actinic-ray treatments.

Infra-red rays can be used by placing the applicator over the pubic and sacral regions alternately. These rays can be used continuously, but usually it is best to use them for an hour or two, then discontinue for a like period of time.

Galvanism, using a copper-ball electrode on the positive pole in the vault of the vagina, using 5 to 30 milliamperes for fifteen minutes thrice weekly, is of decided benefit. The negative pole should be used over the lower abdomen.

Diathermy may be used with a large aluminum electrode in the vagina, the indifferent electrode over the lower abdomen. This treatment should not be used, however, until after the acute symptoms have subsided, when it will aid in restoring the circulation and in absorbing adhesions.

Drugs internally will not be needed except for grave physical debility, then strychnin arsenite, 1/100 of a grain thrice daily, or cinchona, 1/100 of a grain, will be of value. Again the use of sodium iodide, 32 grains, and guaiacol, $\frac{3}{4}$ of a grain intravenously, will aid materially in destroying the infection. It must be used before pus has formed or else after drainage has been established, as it tends to break down the inflammatory zone.

For subdermal cellulitis, a local application of magnesium sulphate, one ounce to a pint of water, can be used as a wet dressing, outside of which may be placed a hot-water bag, an electric pad, the infra-red applicators, or an electric heater for maintaining continuous heat.

Actinic rays from the water-cooled lamp should be given locally for one-half to one minute to destroy the infection. General visible-light and actinic-ray treatments should be used to increase the resistance of the individual. These should be given daily, beginning with one minute and increasing one minute daily until a period of ten minutes is reached, this for each surface treated. The visible light may be used locally as a continuous treatment.

In acute cases, recovery may occur inside of one week, but in chronic cases, particularly of pelvic cellulitis, several weeks or even months may be required to remove all symptoms.

The prognosis in these cases is usually good, although active persistent treatment is necessary.

Case No. 185. Female, age 28. Came to us May 20, 1921, with the following history:

Has had pain and tenderness in the right ovarian region for the past 18 months. Had been under constant medical care for the past three months; very much worse for the past two weeks. Temp. 104° F., pulse 130, respiration 24, and was in constant pain. Examination showed the pelvis filled with an inflammatory mass, in which there is no fluctuation. There was a very free mucopurulent discharge from the cervix which showed gonococci in stained smears. As operation was out of the question at that stage, it was decided to give her actinic-ray treatments, both general and local, which were given as follows:

Time	Radiant Light	Air-cooled Actinic-ray Lamp	Water-cooled Actinic-ray Lamp
May 22, 1921.....	30 min.	1 min.	6 min.
May 23, 1921.....	30 min.	2 min.	7 min.
May 24, 1921.....	20 min.	2 min.	7 min.
May 25, 1921.....	20 min.	2 min.	7 min.
May 26, 1921.....	20 min.	3 min.	5 min.
Less pain, discharge much freer.			
May 27, 1921.....	10 min.	4 min.	5 min.
Less pain, temp. normal.			

Treatments of like time and frequency were continued for one month, with the disappearance of all symptoms and the disappearance of the pelvic pathology. Cultures, one June 7, 1921, failed to grow. She was last seen in September, 1922, when the pelvis was found to be normal.

DIAGNOSIS: Pyosolpinx, Gonorrheal, with extensive Pelvic Cellulitis.

Cervicitis and Endocervicitis.

Cervicitis may be caused by any of the ordinary infective organisms, but is usually of gonorrheal origin. The infection starts from the vaginal surface, spreading to the canal and racemose glands and through these to the muscular tissue of the cervix. This is the first stage of the pelvic pathology which follows gonorrheal infection.

Child-birth or incidental tears are, likewise, primal factors in etiology, permitting the cervical mucous membrane to become irritated and inflamed by coming in contact with the vaginal discharges. The pathology of cervicitis is, therefore, lacerations and infections.

The cardinal symptoms are those of catarrh of the mucous membrane, which may be thin or thick and stringy. If thick and stringy, it usually comes from the cervical canal and if thin, from

the vaginal surface. At times it is extremely irritating, although usually bland. If the inflammatory condition is acute, the discharges may be blood stained, although usually they contain only occult blood. The amount of secretion is increased just before and after the menstrual period.

The disease has no definite blood picture.

Cervicitis must be differentiated from syphilis, carcinoma, tuberculosis, nabothian cysts, chancroid, and mechanical erosions.

The acute cases have considerable pain, per contra the chronic cases have very little pain that is referable to the upper vaginal or cervical region, although backaches are a common accompaniment. These are usually in the lumbar or sacral region. With the extension into the deeper organs of the pelvis, there will be considerable bearing down pains and pains referable to the anterior and inner portion of the thigh.

The advisable methods of treatment are surgery, general visible-light and actinic rays, with added actinic rays from the water-cooled lamp for local treatments. Cautery, medical diathermy, and infra-red rays are occasionally useful. If there are lacerations, they must be corrected surgically or by surgical diathermy, thereby destroying the entire cervix or at least the portion involved. Trachelorrhaphy is the operation of choice. Amputation of the cervix is the more radical procedure.

If the etiological factor is gonococci without lacerations, heat either by diathermy or Percy cautery are the methods of choice. In these cases, sodium iodide and guaiacol intravenously are of value. Drugs by mouth are useless.

The following is the detailed treatment for cervicitis of gonorrheal origin: The Percy cautery is good, using a straight point just large enough to fill the cervical canal. Have it at a dull red heat and insert up to the internal os, leaving it there from two to four seconds; for deep infections, wait about two minutes and repeat for the same period of time. One treatment is usually all that is required and can be done under gas anesthesia. The after-treatment is to keep the patient in the hospital for a few days, giving daily actinic-ray treatments with the water-cooled lamp, using a proctoscope through a bivalve speculum in the usual position for one minute, then rotating it one-fourth in order to reach the anterior and posterior walls for the same length of time. This will also include the urethra and Skene's glands. The treatment should be continued twice weekly until all discharges are negative.

If diathermy is employed, use an insulated sound to fit the cervix and sufficient current to cause slight heat discomfort, which will be about 600 milliamperes for twenty to thirty minutes. If the patient is anemic, use general visible-light and actinic-ray treatments for their anabolic effects.

Prognosis. Barring syphilis, tuberculosis, and malignancies,

the case should be well in a month or two. If due to lacerations and these are repaired, the patient should be well as soon as the surfaces heal.

The prognosis is usually good, even with pelvic infection or tuberculosis, although treatment will be required for several months. If due to syphilis, anti-syphilitic treatment should give definite results in a few weeks. If due to malignancy, the answer will depend upon what can be done for the existing condition and the treatment will be radium or electrocoagulation. If there is metastasis, X-ray treatments may be used to treat the larger areas.

Chancroid.

Chancroid or soft chancre is a specific venereal ulcer in which the bacillus of Ducrey is invariably found.

The pathology is a local ulceration which may be single or multiple. They are usually found about the corona or in the mucous surface of the foreskin in the male, and at the margin of the skin and mucous membrane in the female.

Symptoms. After an incubation of about three days, a pustule develops which ruptures, forming the characteristic ulcer which may be of any shape, has an irregular base, is not undermined and has a foul, gray, serous excretion. The discharge from these sores is infectious and when drained into the lymph glands of the groin, produces the well known bubo.

This disease must be differentiated from the hard (Hunterian) chancre of syphilis, from tubercular ulcers and in untreated cases from destructive ulceration and gangrene. It must also be differentiated from malignancies.

The general management is cleanliness and the avoidance of carrying the infection to others.

The modalities useful are actinic rays and electro-coagulation or desiccation. Actinic-ray treatments consist of the use of the water-cooled lamp for one or two minutes at a distance of about one inch over and around the ulceration and if the inguinal glands are enlarged, over the entire inguinal regions for about the same length of time. The case may be complicated by either syphilis or gonorrhea or both.

The average period of time required for treatment will be about one week or ten days. The ulcer tends to recover in about four or five weeks if untreated, provided infection of the lymph glands does not occur.

The prognosis is good. Further complications are phimosis or paraphimosis, which may need surgical treatment.

Case No. 262. Male, age 25. Came to us on July 2, 1917, in the following condition: Three ulcers on the penis and foreskin, one dorsal ulcer on the left side and one at the frenum. All ulcers had existed for six weeks despite treatment.

July 2, 1917, he was given a two-minute treatment with the water-cooled lamp at a distance of one inch. A ten per cent solution of oleum terebinthinae in oleum olivae was applied locally. Like treatments were given every second day and healing began from the first and was complete in twelve days.

DIAGNOSIS: Chancroid.

Chlorosis.

Chlorosis is usually classed as a primary anemia affecting only the female sex.

Its etiology being that of endocrinology because it affects the female sex only, is typical but not sufficient. The average age is from twelve to fifteen years.

There is no definite pathological picture, although a general puffiness (plumpness) of the body is noted, together with a peculiar greenish-yellow pallor. The obese condition is probably due to subdermal cellular edema.

The cardinal symptoms are dyspnea, followed closely by cardiac palpitation. The usual symptoms are those of vertigo, impaired digestion and derangement of the vegetative function accompanied by a stubborn constipation. Amenorrhea is the rule, although in many cases there is a deficient flow instead, which is irregular and painful. Neurotic conditions are pronounced. Cardiac murmurs of the hemic type are common and the pulse is usually unduly rapid.

The blood picture is characteristic with its low hemoglobin, fairly normal erythrocyte count, and the normal arrangement of the differential white count. Very definite changes are noted, the hemoglobin ranging as low as ten per cent, and seldom above fifty. The red cells are diminished, although not in proportion to the hemoglobin, which gives a low color index. The total leucocyte count may be normal, subnormal, or hypernormal, but regardless of the number of leucocytes their normal arrangement is seldom disturbed.

Chlorosis must be differentiated from leukemia, Hodgkin's disease, secondary and pernicious anemias, hyperthyroidism and chronic nephritis.

Diagnosis will rest upon the symptoms given, together with the disproportion between the hemoglobin and red cells.

The treatment consists of an outdoor life, the administration of Bland's pills and general visible-light and actinic-ray treatments, which should be given from daily to thrice weekly.

The prognosis is good.

Cholecystitis.

Cholecystitis may be either acute or chronic.

Its infective etiology will usually be found in the lower seg-

ment of the stomach and upper intestinal tract. Occasionally it occurs through the portal system and less frequently by extension from the liver. In the majority of cases, the infective organisms will be found to be streptococci, although less frequently the amoeba coli or staphylococci will be found to be the predominating infective organism. Pneumococci, typhoid and tubercular bacilli are occasionally factors, as are the echinococci and ascaris lumbricoides. Malaria, nephritis, gall stones, chronic heart disease or its complications, and sudden surface chilling may be the etiological factors. Typhoid bacilli may persist for years in the gall bladder and be the nucleus of gall stones.

The pathology is an inflammation of the mucous lining of the gall bladder which may be mild in character or severe enough to cause gangrene of the entire organ. The latter is most likely to occur when the gall duct is obstructed by stones or by the collection of mucus of such tenacity as to prevent the emptying of the gall bladder, thus allowing bacteria to develop in such large quantities that they produce an empyema of the gall bladder.

The cardinal symptoms of this disease are pain, tenderness, fever, a high leucocyte count, very little jaundice, and the presence of bilirubin in the urine.

The associated symptoms are those of acute dyspepsia with the clay colored stools, a very slow pulse, generally a sluggish mentality and surface itching. The gall bladder may or may not be enlarged below the costal margin. If there is complete obstruction of the common duct, there will be a sufficient tension and enlargement of the gall bladder to be felt below the costal arch in the nipple line.

Diagnosis. The condition should be differentiated from gastric ulcers, appendicitis, kinked ureter, gall stones either in the gall bladder or in the common duct, also from an echinococcic cyst and malignancy. Adhesions accompanying cholecystitis may produce intestinal obstruction or symptoms of dyspepsia. Bile stained pus cells in the duodenal fluid indicate cholecystitis. They are obtained by the duodenal tube. The principal differentiation will be between acute appendicitis, perforating gastric ulcer, and cholelithiasis and an exploratory operation may be necessary to determine which exists.

The general management of these cases will consist of the elimination, as far as possible, of all possible etiological factors. During this time, rest in bed for a few days is imperative. The diet should be light and non-stimulating. The bowels should be kept open by alkaline laxatives.

The useful therapeutic modalities are surgery, if there are gall stones or adhesions, diathermy, visible light, and actinic rays. Vibration may become valuable and should be given over the mid-dorsal region.

The drug that will give the best results is magnesium sulphate by proctoclysis, giving about forty drops per minute of a solution of one dram of magnesium sulphate in one pint of water.

General treatments of visible light and actinic rays with an intensification of the actinic rays over the gall bladder and epigastric region, as recommended for gastric ulcer, will be of value in simple cholecystitis.

Diathermy should be given with a 4x5 inch electrode of composition metal on the back opposite gall bladder and a 3x4 inch electrode placed over the gall bladder, and should be fixed by sand bags in perfect contact with the skin. The d'Arsonval current is used at a milliamperage of about five hundred for thirty minutes daily. Diathermy is also valuable for the adhesions which frequently follow operations in the upper abdomen.

The principal diseases complicating cholecystitis are gall stones, empyema, malignancy, adhesions, gastric or duodenal ulcer, and typhoid fever.

The average length of time the case will require treatment will be from a few days to a few weeks.

Barring complications, the prognosis is good. Recurrences are fairly common.

Case No. 289. Female, age 43. Came to us February 20, 1925. She had had symptoms referring to the gall bladder at varying times for the past four years.

April 24, 1924, Edwin C. Ernst, M. D., St. Luke's Hospital, St. Louis, Mo., made the following report: Examination of the gall bladder region shows an area of increased density simulating a thickened gall bladder or possible calculi. A pyelogram made by Dr. Ernst April 26, 1924, at the same hospital showed no evidence of kidney pathology.

February 25, 1925, urinalysis No. 78578 at the National Pathological Laboratories, Chicago, did not show evidence of any bladder or kidney lesion. In May, 1924, the leucocyte count ranged as high as 22,800.

At the time I first saw her, there was an increased area of dullness in the gall bladder region which was extremely painful on palpation. Her first treatment consisted of diathermy, 600 milliamperes for ten minutes, using a 5 by 6 composition-metal electrode posterior to the gall bladder, and a 3 by 4 anterior. This was repeated three days later, increasing the time to twenty minutes. The same size of applicators was used in the treatments that followed with 500 to 700 milliamperes of current, given from fifteen to thirty minutes. Each time she was treated with the diathermy current she was given twenty minutes of visible light and from one to ten minutes of actinic rays. There was relief of pain after the fifth treatment and relief of the soreness after the tenth treat-

ment. She continued the treatments at varying intervals for three months with no return of the trouble.

DIAGNOSIS: Cholecystitis.

Chorea (Sydenham's).

Chorea usually occurs between the ages of five and sixteen years. More than two-thirds of the cases occur in the female. Many types of the disease have been described but they are usually symptoms of varying periods.

The etiology is infection, probably streptococcic or auto-intoxication, due to faulty metabolism and coupled with this is mental strain, worry, or shock or anything that over-excites the emotions.

There is no definite pathological lesion.

The cardinal symptoms are involuntary muscular movement, which occurs in various portions of the body, but in the individual case they usually occur in the same general muscular region. These symptoms develop gradually, varying at times in severity, but reach their height in from two to three weeks. The part of the body affected during this time will, in the main, be the portion affected during the course of the disease.

The movements are jerky and very rapid and unlike those of any other disease. Any portion of the body may be affected. Voluntary efforts to prevent them only increase their severity. They cease entirely during sleep.

The toxemia is usually of sufficient severity to produce a stupid mentality. Even in cases of moderate severity, the respiratory symptoms are observed to be jerky and are definitely interfered with. Even in the most severe cases, these patients never become unconscious.

All voluntary movement may be affected. There is little, if any, change in the renal function from the normal. Anemias may develop from impaired nutrition.

There is no definite blood picture.

Diagnosis. If the age of the child is remembered and particular attention paid to the involuntary movement, there should be little difficulty in diagnosing this condition. It must be differentiated from hysteria, muscular weakness or paralysis following acute anterior poliomyelitis and the irregular, slow, peculiar, incoördinate movements of paresis, which are sufficient to differentiate them from chorea. It must also be differentiated from tic, which is a local spasmodic condition affecting only one set of facial muscles.

The general management of these cases requires well regulated out-of-door exercise, occasionally rest in bed, diet light but nourishing, and a life free from worry or excitement.

The modalities useful are visible light, actinic rays, hydrotherapy, and massage. Among the useful drugs are arsenic, which

should be given as sodium cacodylate intravenously in doses of one-fourth to one grain from daily to three times weekly. Agari-cine, 1/100 of a grain every one to four hours, is a reliable drug. Actaea racemosa in doses of 1/100 of a grain is of special value at the time of puberty, likewise pulsatilla in the same dosage. Cuprum arsenite in doses of 1/100 of a grain several times daily is of value when other remedies fail; ergot for its effect upon the circulatory system and hyoscin hydrobromate for its sedative action, the latter in doses of from 1/200 to 1/1000 of a grain daily. This drug is particularly useful for the more severe cases. Cod-liver oil in limited doses is of decided value.

Thyroid, pituitary, and para-thyroid are among the endocrine products which should be useful for their effect on general metabolism. Sedatives, if used at all, should be prescribed with a great deal of caution. Other drugs useful in this condition are the laxatives used to keep the intestinal tract free from putrefaction.

General treatments of visible light and actinic rays should be given daily until there is definite improvement, then three times a week.

Complications that are likely to be associated are rheumatism, endocarditis, anemia, and arthritis.

If given proper hygienic surroundings, these cases tend to recover by themselves in from three to six months and this fact must be remembered in recommending treatment of any kind.

The prognosis is good in all cases which are free from complication.

Case No. 338. Female, age 24. Was referred to me October 4, 1917. Had been exceedingly nervous for some time, but of late there was considerable jerking of the muscles about the head and neck and to some extent throughout all the limbs. This jerking had grown so severe that it was impossible for her to be about.

Her treatment consisted of general visible light, actinic rays, and vibration along the spinal column. After the first treatment she had six hours of relief and after the third treatment, twenty-four hours. The next day there was a return of the muscle spasm for a few hours. After the tenth treatment the spasms disappeared entirely and fifteen treatments over a period of one month were sufficient to relieve her completely without future return of the symptoms.

DIAGNOSIS: Chorea.

Cicatrix or Scar Tissue.

The fibrous connective tissue left after the healing of soft tissues, whether from accidental trauma, from chemicals, suppuration, or from surgery, can be softened by the use of negative galvanism.

Clay electrodes are best for this purpose, as they mold perfectly to the scar, be it concave or convex. These should be used

with the negative electrode and saturated with a sodium chloride solution. The indifferent electrode, or positive pole, should be placed as nearly opposite the scar as possible. This indifferent electrode may be much larger than the active, thus lessening the possibility of an acid burn, which is hard to heal, and which leaves an adherent, hard, contracted scar. This indifferent electrode may be of any soft material capable of absorbing and retaining moisture. Asbestos is probably the best, and this electrode, like the active one, should be moistened with a solution of sodium chloride.

Turn the current on and off very gradually to avoid any shock. The tolerance of the patient should be the guide, as in all electrical treatments.

In the case of scar tissue, a few milliamperes is all that is necessary in any region, and for scars about the head one must be extremely careful not to cause syncope. The brain will stand more current anteroposteriorly than it will laterally, but very few milliamperes either way. It is impossible to give exact milliamperage or the location and size of the electrodes needed. Caution should be the rule.

The treatments should be given daily until there is definite improvement, then less frequently. Some scars yield in a few treatments, others may take months.

In addition to negative galvanism, deep muscle cicatrices should receive diathermy and for fibrous ankylosis about joints diathermy should be used in preference to all other modalities. Massage, stretching, and hydrotherapy are valuable aids.

Contagious Diseases.

Contagious diseases, as scarlet fever, measles, whooping cough, diphtheria and erysipelas, should all be benefited by the use of the visible-light and actinic-ray treatments, both local and general, if given in a contagious hospital where there would be no danger of transmitting the disease to another individual through the apparatus, as bacteria accompanying or causing these diseases are destroyed by actinic rays, but these diseases should not be treated by the same apparatus used to treat non-contagious diseases, neither should these cases be permitted in the office where non-contagious cases are treated.

The actinic rays from the water-cooled lamp will be found particularly valuable in the treatment of diphtheria carriers. These treatments should be given for about two minutes, covering in this time the entire throat, including tonsils, fauces, pillars, palate, and buccal cavities.

Constipation.

Constipation is an indefinite term which usually means a prolonged retention of fecal matter within the rectum and colon and for the purpose of this article will be so used. However, there is

no definite number of daily bowel movements which may be considered normal. One person may not have a movement for two or three days, yet be perfectly normal, and another may have three or four a day and not be abnormal. It is usually understood that a person to be healthy should have from one to three bowel movements in twenty-four hours without assistance from medicine or physical means. Prolonged retention from paralysis cannot be called constipation.

The usual etiological factors of this disease are indifference to the call of Nature or the impossibility of answering such a call, together with dietetic errors and lack of fluid taken into the system as food or drink. A proctoceles may be an etiological factor.

Drugs, such as astringents or opium or its derivatives, produce a stoppage of the bowels, but are not to be considered as constipation.

There is no definite pathology, although many pathological factors accompany the condition, constipation.

There are no cardinal symptoms. Among the usual symptoms of constipation are those of auto-intoxication, which are manifested by slowness, lassitude, mental depression or headaches, with indigestion or an absence of any appetite at all, sometimes by nausea and vomiting. If accompanied by fermentation, there will be colicky pain at different parts of the abdomen; vertigo is common and at times the pulse is affected, being either rapid, irregular or extremely slow. Pyrosis often coexists with this condition. The tongue is usually coated, although not necessarily so. Since a bowel movement gives relief from these conditions, it might be considered a point in differential diagnosis.

Cases are frequently found where retained fecal matter forms a great mass or ball somewhere along the colonic tract or in the rectum. It may be accompanied by a continuous diarrhea, which may or may not contain blood. Sometimes the liquid feces are passed through the mass and at other times around it. Where diarrhea persists in spite of treatment, the bowel should be thoroughly examined for these fecal masses which must be broken up for removal.

If the blood picture is at all changed from the normal, it will be to that of a secondary anemia.

Sacral or lumbar pains are at times severe and occasionally will extend down one or both sciatic nerves and to relieve this it will be necessary to produce free evacuation.

The diagnosis of the condition will be based upon the hard fecal masses being passed or upon finding such masses within the bowel.

Differential diagnosis must be established in all cases before starting treatment to determine the absence of mechanical obstruction such as strictures, adhesive bands or kinks in the intestine. Adhesive bands may cross the intestine causing obstruction.

Occasionally a subinvolted or fibroid uterus will produce a pressure sufficient to cause obstruction. Concretions within the bowel are inclined to produce ulceration and if long retained are usually associated with mucus colitis.

Hemorrhoids often accompany, either as varicosities or as bowel protrusion and prolapse may result from the straining.

The general management of these cases will consist of good hygiene, systematic exercise, and a diet largely of the coarser foods containing sufficient residue to be passed on.

The modalities useful are massage, sine currents or interrupted galvanism, general light treatments, and drugs. The drugs, however, are only used for temporary relief and of these phenolphthalein is one of the best. Occasionally castor oil or the mineral oils taken in small doses daily are of value.

The main feature in the treatment of constipation is to produce the desire on the part of the individual to have a stool after one meal, usually the first or last of the day, at which time the bowel is more likely to act naturally than at other intervals. A movement after each meal is a more normal requirement. A glass or two of water, either hot or cold, at the pleasure of the individual, taken the first thing upon rising in the morning, will aid materially. Hot water seems to act best for most people. The slow sine current with one pad in the dorsal region about fifth to eleventh, the other over the colon in four places, beginning at the caecum, then over the hepatic flexure, splenic flexure, and sigmoid for a period of about ten minutes for each place and of a sufficient quantity of current to cause a deep or pronounced contraction of the abdominal wall, in fact all that the patient will tolerate without discomfort, should be given for this period. While the sinusoidal current is being used, the patient should be instructed to use the will power to aid in the contraction of the abdominal muscles while the electricity is acting. These treatments should be given daily or every other day until regularity is established, which in the average case will take from two to three weeks up to as many months.

Massage, both local and general, is of the utmost value. Vibration is also of value in these cases. It should be used following the course of the colon, beginning at the caecum, with additional vibration over the dorsal vertebrae from the eighth to the eleventh.

General actinic-ray treatments will help these cases in a general way only, by correcting the secondary anemia, which accompanies these cases, and to stimulate the nervous system. Small doses of strychnin arsenate 1/100 of a grain twice or three times a day will aid the latter. Nux vomica and cinchona in a like dose will sometimes act as a stomachic tonic.

Where there are hard masses in the rectum, not too large to be passed, oil enemas are of value. These should consist of about one-half pint of olive oil or cotton-seed oil, and when nothing else will

act, use kerosene oil. Enemas of plain cold water at times excite the bowel contraction and are of value but should be used with caution in debilitated individuals.

The prognosis is good, provided you can get the coöperation of the patient.

For the constipation of infants, immediate relief may be obtained by the introduction of the well oiled little finger or the use of glycerin or gluten suppositories.

Colitis and Enterocolitis.

Colitis is an inflammation of the large intestine. The inflammation may be associated with inflammation of the small intestine or enterocolitis. These should be studied and treated together. The disease may be either acute or chronic.

Among the etiological factors are over eating, improper food, food improperly cooked, or foods that are partially spoiled, which applies particularly to shell fish or to other toxic substances or irritants. Sudden chilling of the body is also an etiological factor. Impure water must also be considered and nervousness sufficient to cause a simple diarrhea, if prolonged, may become a colitis.

We have, as an etiological factor, the various dysentery bacilli which may produce the disease by infection, and last but not least, constipation.

The pathology is not distinctive. In the early stages there may be a simple hyperemia or congestion of the mucous lining of the bowel which may in the few cases become permanent. As the disease progresses and reaches the chronic stage, there is likely to be atrophy with possible ulceration of the mucous membrane lining the bowel.

Symptoms. The cardinal symptom of colitis, or enterocolitis, is a mucus diarrhea. This accompanies practically every stool, and mucus may be the only substance evacuated. If there is severe inflammation or ulceration, it may be accompanied by blood, either occult or macroscopic. With the healing of the ulcers there may be contracted areas in the lumen of the bowel.

The disease must be differentiated from parasites, dysentery, syphilis, ulceration due to X-ray treatment, tuberculosis, and malignancies.

The usual symptom is diarrhea, which may or may not be accompanied by colicky pains. The stools may be of most any color or consistency, but always carry with them the characteristic mucus. General debility is common, although the symptom pain is comparatively rare. Pain is more common if the rectum is the portion involved as in proctitis.

General management. The patient must be kept on foods easy to digest or, better still, predigested foods, and no condiments allowed. The case should be given complete mental rest if possible. Sweet milk is without doubt the best diet in the early stages of

the treatment of this disease, or it may be replaced with malted milk or Bulgarian cultured milk.

The modalities which are useful in the treatment of colitis are drugs, visible-light and actinic-ray treatments, and if associated with constipation, but not impaction and diarrhea, the slow sinusoidal current.

The drugs used internally will be chlorodyne No. 2 for pain, copper arsenite 1/100 of a grain, one dose with each stool. As a rule, it is well to begin the treatment with a small dose of castor oil and frequently castor oil in doses of one teaspoonful daily will be a valuable aid in the control of this affection. Retention enemas of two ounces of a five to twenty per cent solution of krameria (fl. ex.) in warm water are of value. These may be given daily to three times a week.

The light treatments should be general with an extra actinic-ray treatment over the course of the colon sufficient to produce a mild hyperemia. If the inflammation is in the sigmoid or rectum, actinic rays from the water-cooled lamp through the sigmoidoscope or proctoscope will be of definite value.

Complications most likely to arise are those of a general nature, due to the absorption of toxins from the bowel. These may produce symptoms that are varied and multiple.

The average length of time that the case will be under treatment will vary from a few days, in the acute cases, to months in the old chronic cases.

The prognosis is good as to recovery, but if the ulceration has produced strictures of the colon, they will be permanent.

Case No. 428. Female, age 51. Came for treatment November 15, 1923, complaining of frequent mucus stools accompanied by tenesmus. At times the stools were blood streaked and were accompanied by large amounts of flatus. A sigmoidoscopic examination revealed an inflamed and eroded colonic mucous membrane with small dots of blood at the site of the erosions.

Her treatments consisted of general visible-light and actinic-ray treatments every second day and krameria (fl. ex.) 10% in warm water. Of the krameria solution two ounces were given as a retention enema. Her progress was steady from the first and twelve treatments were sufficient to remove all traces of the inflammation.

DIAGNOSIS: Mucus Colitis.

Acute Coryza.

Acute coryza is an infection of the upper air passages by various infecting organisms, chief among which are the micrococci catarrhalis and staphylococci.

The condition is usually contracted in crowded, overheated, and badly ventilated public vehicles and public assemblies.

The pathology is an inflammation of the mucous membranes of the upper air passages.

The first symptoms are chilliness with sneezing, which is due to the congested mucous membranes, followed by a sore throat and, at times, general aching, resembling in this respect influenza. There is frequently an accompanying laryngitis which may be followed by aphonia. Otitis media is a frequent complication, as the infection spreads into the eustachian tubes.

Differentiate it from influenza, hay fever, and iodism. Also from measles, which always has a cough that nothing will control until the eruption disappears and the cough always subsides with it regardless of treatment.

The treatment consists in the use of one of the silver salts for nasal packs or better still magnesium sulphate as a gargle and nasal douche (1 to 50 in water). For the laryngitis, the above can be used as a pack (1 to 16) which is best applied ice cold.

The physical-therapy treatment consists in placing the patient either in a visible-light bath cabinet for thorough elimination or under a 1000 watt clear bulb for 30 to 60 minutes. The lamp should be centered over the face and upper thorax. This should be followed with a treatment of one minute with the air-cooled lamp and the use of the quartz-rod applicator on the water-cooled lamp in each nostril for a period of two minutes and a mouth and throat raying for one minute.

Sodium iodide, 32 grains, and guaiacol, $\frac{3}{4}$ of a grain, given intravenously, aid materially in stopping the infection.

One to three of the above treatments are usually all that are required.

Cysts.

Cysts occur in nearly every tissue of the body, but only those that are superficial and benign can be treated by physiotherapeutic methods. The larger ones, whether benign or malignant, must be removed surgically.

All cysts are lined by an epithelial membrane from which the secretion occurs, which is responsible for the contents and the growth of the cyst.

The treatment of these conditions demands the eradication of the cyst wall, either by removal or destruction with cautery. If the former, the wound should be closed aseptically and every effort made to obtain healing by first intention. If, however, the cyst wall is destroyed by cautery or electrocoagulation, drainage must be instituted and maintained until the entire cavity is healed. Under these conditions actinic rays from the water-cooled lamp will be found of value in maintaining or producing asepsis. Either cautery in the form of metal heated to a dull cherry red or electrocoagulation or desiccation should be used.

The deeper cysts are all surgical and the reader is referred to books on surgery for the technique used in their treatment.

Cystitis.

Cystitis usually means an inflammation of the urinary bladder. The various types are simple, tubercular, gangrenous, malignant, and venereal, which may be either simple, inflammatory, or ulcerative. Any of the types may be either acute or chronic.

The pathology of acute cystitis may be a highly inflamed bladder wall which may be general or local. In the simple chronic type, which is the most common, the bladder wall is likely to be fibrosed and atrophic and the mucous membrane a light pink or white.

The etiology will be an infection and is frequently due to catheterization or instrumentation.

The cardinal symptom of all types is pain. This is most pronounced just as the bladder is emptied and least pronounced when it is fairly full. The usual symptoms are frequent, painful urination and urine which contains pus and blood, which may be either occult or macroscopic.

The diagnosis will depend upon the findings in the urine and the cystoscopic examination of the bladder wall. Cystitis must be differentiated from prostatitis, posterior urethritis, and from caruncular conditions.

The general management of these cases will consist of the best hygienic treatment possible with the least amount of exercise or in severe cases, rest in bed. The diet should be bland and non-stimulating. Heat over the bladder is useful at times as a palliative measure and sometimes hot douches or hot rectal injections will give decided relief.

Of the therapeutic modalities, actinic rays stand first, followed by visible light and infra-red rays. Surgery is seldom, if ever, required in treating simple cystitis, which is of bacteriological origin.

Drugs, internal or intravenous, are rarely useful. Argyrol, ten per cent solution, or mercurochrome, one per cent solution, may be used by instillation into the bladder after it has been emptied. These should be permitted to remain until urinated.

Actinic rays should be given through a bivalve speculum in the female and through a proctoscope in the rectum of the male. General visible-light and actinic-ray treatments are also of value in building up the resistance of the patient.

The complications occurring in cases of cystitis are ulceration or extension due to the fact that the bacteria may spread upwards through the ureter into the pelvis of the kidney.

The average length of time the simple cases will require treatment will be from a few days to a few weeks.

The prognosis is good.

Tubercular cases will require much the same treatment, but over a prolonged period of time.

The venereal cases will require anti-venereal treatment, while the malignant cases will require destruction of the malignant area if this is at all possible. For areas not larger than a half-dollar, electrocoagulation is the best method of treatment, as this can be done through a cystoscope. Larger areas will require a suprapubic opening with the partial destruction of the growth by electrocoagulation followed by the burial of radium needles in the bladder wall.

The prognosis of these cases is very grave.

For the malignant cases, general visible-light and actinic-ray treatments act as a stimulant to help build up the resistance of the patient following the destructive measures, but are valueless for the cure of the malignancy itself.

Case No. 377. Male, age 46. Came to the office December 6, 1917, at which time he gave a history of having had pain in his lumbar region for the past ten years. For the past three years he had had frequent attacks of painful urination which had been treated with injections of argyrol. For the past six weeks he had had difficulty controlling the bladder. Jarring caused an increase in the pain in the pelvis.

He was given general visible-light and actinic-ray treatments and local rectal treatments with the water-cooled lamp (time two minutes in each of three places) for three weeks to get control of the bladder infection, at which time a cystoscopic examination revealed a large stone in the urinary bladder. This was removed surgically the following day by suprapubic cystotomy. His recovery from the operation was uneventful and his cystitis did not recur.

DIAGNOSIS: Cystitis due to Lithiasis.

Case No. 485. Female, age 37. Postoperative cystitis for more than a year. Pain almost constant, which was increased on urination. Cystoscope revealed inflamed area in trigone and posterior urethra.

First actinic-ray (water-cooled lamp) treatment, July 9, 1918, was of five minutes' duration, through a vaginal speculum, through which the medium-sized Clark applicator was introduced. A second treatment of seven minutes was given on the 11th, after which there was some improvement. On the 13th, her treatment was of ten minutes' duration, but, as it blistered her badly, it was decreased to six minutes on the 16th, and to five on the 23d, at which time there was very little evidence of the former trouble.

DIAGNOSIS: Cystitis.

Dermatitis.

Dermatitis is a general term describing various skin inflammations. It characterizes inflammation ranging from erythema

through papules and pustules to complete destruction of the skin and is variously described and explained by different authors.

Its principal etiology is toxemia from infection or external irritants, as poison ivy or oak, croton oil, mustard, arnica, iodine, formalin, cantharides, dyes and strong acids or alkalies, originating from various sources, principally vegetative, plus a neurotic constitution and should be so treated. Other cases are due to exposure to the sun's rays or short actinic rays. However, it must be remembered that many cases are drug eruptions.

The characteristic symptom is a redness of the skin with bilateral distribution. There is also constant itching due to congested capillaries. It must be differentiated from impetigo, scarlet fever, and rose rash.

The general management of the case consists of a good hygiene, plenty of outdoor exercise, and a restricted diet or better still fasting for a few days. Special attention should be given to the alimentary tract and free bowel evacuations maintained. As soon as the latter is emptied, an examination of the lower bowel and sigmoid should be made with a sigmoidoscope for colitis.

The treatment consists of drugs given internally, subdermally, and intravenously. Among the drugs arsenic is the most valuable. This may be given with strychnin as strychnin arsenate 1/100 of a grain by mouth thrice daily or as calcium cacodylate intravenously or intermuscularly in doses of one grain daily to twice weekly. If due to bacterial infection, sodium iodide and guaiacol intravenously will be of value. Occasionally an autogenous toxin will be required and will give the best results.

Of physiotherapeutic treatments, general visible light and actinic rays, with the air-cooled lamp for one or more minutes, will give results not obtainable by any other means. For small lesions, the use of the water-cooled lamp over the diseased area at a distance of about one inch for a few seconds will be found of great value for relief which is many times immediate.

Dermatitis due to drug irritation will require the removal of the drug and an antidote to its action, if this is at all possible.

Dermatitis Venenata usually refers to skin poisoning by rhus toxicodendron, rhus diversiloba, or rhus venenata and is best treated by actinic rays from the air-cooled lamp for a few seconds at a distance of about six inches, to be followed by continuous applications of a magnesium sulphate solution in strength from one ounce to a pint of water up to a saturated solution. This may be applied either as a wet dressing or by sponging the surface and permitting it to dry thereon. This should be preceded and as soon as possible after exposure by thorough washing with soap and water after which the surface should be washed with benzine or alcohol to remove and dissolve the irritant principal of the rhus. Relief in these cases is almost instantaneous and even severe, long standing (several weeks) poisonings are well in from two to three weeks,

mild ones in a few days. Sodium hyposulphite solution one dram to an ounce is useful as a local application.

For the X-ray or radium dermatitis, there is nothing to equal a minute or two of actinic rays from either the air- or water-cooled lamp, repeated daily. Relief can be expected within a few days in the acute cases, and within weeks or months in the chronic.

When the various etiological factors are considered, it will be readily understood why this disease has a tendency to recur at regular intervals over a period of years. This must be taken into consideration when relief from any therapeutic measure is considered.

The average length of time that a case will require treatment is from one to four weeks.

The prognosis is good, although recurrence is frequent.

Case No. 481. Male, age 56. He came to us January 14, 1925, and gave the following history: One week previously the nostrils became sore and red. This condition spread to the skin of the right cheek and about the right eye. The area was red, slightly edematous, not painful but uncomfortable. There had been neither chills nor fever.

He was given a one-minute treatment (for the entire face) with the water-cooled lamp on January 15, 1925, a like treatment the next day at which time there was some relief. Two days later a like treatment was given though the condition was greatly improved and this was all that was needed.

DIAGNOSIS: Dermatitis.

Diabetes Mellitus.

Diabetes Mellitus is characterized by a continuous glycosuria of undetermined etiology but probably due to some dysfunction of the pancreatic gland with an associated neurosis, these, many times, following an acute infectious disease or traumatism particularly injurious to the head.

The cardinal symptom of the disease is an enormous increase in the total output of the kidney function and in its content of a large amount of sugar. The quantity of sugar usually varies from two to six per cent of the total output and at times reaches eight per cent. The specific gravity varies from 1.025 to 1.040 and even higher in exceptional cases. Hyperglycemia is invariably present. The blood of a normal individual contains about one gram of sugar per liter of blood while in diabetes it may run as high as ten grams per liter in the late stages of the disease, average two to five grams per liter.

Usually the first symptoms to attract the attention are thirst from dryness of the mouth, and polyuria, although occasionally pruritis is first. This may be either general or local about the genitals. Most patients with diabetes are obese and usually indulge in a superabundance of starches and sugars.

Hyperglycemia precedes glycosuria and is, therefore, valuable in prognosis. With the blood and urinary pictures, there can be no doubt of the diagnosis.

Furunculosis, carbuncles, and gangrene are frequent complications of the disease. The minor complications are eczema, pruritis, and dermatitis which is manifestly a chronic disorder. In young children, it is frequently fatal and runs a rapid course.

The general management of the case is of the utmost importance. Good hygiene with regulated exercise is important and is preceded only by that of diet, which should be as nearly free from sugars and starches as the occupation and general condition of the patient will permit. Vegetables containing the least amount of starches should be relied upon mainly to supply the essential foods. In addition to the green vegetables, meat, fish, and eggs should be the principal diet.

Diabetic treatment is first and foremost dietetic. Starvation diet should not be carried on for more than a few days when the patient must be returned to a vegetable diet as free from starches as possible and the carbohydrate tolerance must be found and maintained. Celery, rhubarb, spinach, turnips, and carrots are well borne by all diabetics. Once a diabetic is sugar free or nearly so, he must be informed that his condition can remain so only if he maintains a strict diabetic diet, meaning the absence of sugars and the diminution of his carbohydrates for the remainder of his life. In other words, there is no positive cure for diabetes in the sense that a patient can eventually return to an unlimited carbohydrate diet. After the diminution or elimination of the glycosuria, the patient may add to his diet meat, particularly fat meat, fish, eggs, and the various green vegetables low in starch content. A fast of one day a week is of value in many of these cases. No diet should be insisted upon that disagrees with the patient.

Among the foods that a diabetic should not take are oatmeal, cornmeal, buckwheat, vermicelli, tapioca, rice, all kinds of potatoes, white bread, and navy or lima beans. The white bread should be substituted by a rye bread or better still a gluten bread. Soy bean meal also makes a good bread for diabetics. Practically all leafy and watery vegetables may be included in a diabetic diet. Fruits, particularly the non-sugar varieties, may be used with caution. Milk, cream, and fresh butter are usually well borne by diabetics as are olive oil and in some instances cod-liver oil. Total abstinence from all beverages containing sugar must be insisted upon.

Drugs in any form have but little effect upon the diabetic. One exception to this rule, however, is potassium nitrate, which may be given in five-grain doses intravenously every day until the sugar content of the urine has dropped materially and then about three times a week.

General body hygiene is essential. Mild exercise is advantageous to the obese diabetic. After the urine has become sugar free or nearly so, the blood sugar content should be watched carefully as impending trouble can be detected here before it shows in the urine.

An equable climate is an advantage in the treatment of diabetics for sudden changes of temperature decrease the elimination of the skin, which is detrimental.

The acidosis accompanying diabetes is best counteracted by the use of sodium bicarbonate in large doses, and in advanced cases it should be administered intravenously. If the case is comatose, only temporary relief may be expected. In giving sodium bicarbonate intravenously, eighteen grams to a liter of sterile water is about the right proportion. This solution should be boiled, then filtered. Of this as much as 1500 cc. may be given at one time provided it is given slowly and with very little pressure—from one to two hours of time should be allowed for its introduction. An isotonic solution of sodium bicarbonate is 1.8% in strength. A solution of this same strength may be used for proctoclysis (40 to 60 drops per minute) in less advanced cases. Hypertonic solutions are dangerous, while hypotonic solutions like the red blood corpuscles and are, likewise, dangerous.

For the symptoms of the late stage of diabetes, insulin is of value as a palliative measure but in no case curative and must be used with a great amount of caution.

The treatment of diabetic gangrene is similar to the treatment of gangrene from other causes with this exception, that if the urine cannot be made sugar free and blood sugar materially reduced or brought to normal, there is little chance of recovery. This applies particularly to the moist type of rapidly spreading gangrene which has a nearly hopeless prognosis. Amputations are sometimes of value and are to be considered in treating these cases.

Carbuncles and furunculosis are frequent complications in the diabetics and should be treated as are these conditions with other etiology.

In the treatment of diabetes where there is no decided acidosis or coma, general visible-light and actinic-ray treatments are of distinct value. The blood sugar and acetone bodies are decreased by actinic radiations from the quartz-mercury lamps following visible light. These treatments should be given daily at first, then less frequently with intravenous injections of potassium nitrate in doses of five grains with, of course, the enforced diabetic diet. Under this treatment, these patients should show a definite improvement within a few days but must continue their treatment until the urine is sugar free or nearly so and they have been restored to at least a maintenance diet suitable for the occupation of the patient, and this means many months with future observa-

tions from time to time to maintain a proper diabetic method of living.

Galvanic and high-frequency treatments have seemed to be detrimental in a number of these cases and must be given with caution and when a low blood pressure is found accompanying a glycosuria, these methods must not be used to raise the blood pressure. Constipation must not be permitted in these cases, neither must active cathartics be employed. The diet should be so arranged as to care for at least one daily movement and water sufficient to allay thirst must be allowed.

Diathermy through the pancreas is in the experimental stage but may be worthy of a trial.

The prognosis is bad as far as complete recovery is concerned although many of these patients will live for ten or fifteen years if they are careful with their diet, their hygiene, their exercise, and what is equally essential, the proper mental attitude towards their disease.

Glycosuria is a digestive disturbance due to an inability of the system to burn up sugars and starches. It is unaccompanied by hyperglycemia and is not a true diabetes mellitus.

Case No. 555B. Female, age 50. Came to me May 12, 1920. She gave the following history. Menopause at 46, no signs of any flow until two days ago, when she started flooding. She also stated that she had been having from 3% to 6% of sugar in the urine for some months.

Pelvic examination revealed a deeply ulcerated cervix and an enlarged fundus uteri.

Operation was not to be considered so 50 mg. of radium in a capsule were inserted into the cervix and left for 24 hours. At the time the radium was inserted a specimen was taken and reported carcinomatous. The flooding stopped after a few days and her general condition improved. She remained in the hospital for two weeks and during this time the percentage of sugar in the urine was reduced from 6% to 3%. After the third day in the hospital she was given daily general visible-light and actinic-ray treatments. After two months of treatment she was in good general health and was having but a trace of sugar in the urine.

One year later, May, 1921, she had a return of sugar in the urine up to 4%. Nine general visible-light and actinic-ray treatments were sufficient to lower the sugar to a mere trace. A carbohydrate free diet was insisted upon throughout the treatment.

DIAGNOSIS: Carcinoma of Cervix and Diabetes Mellitus.

Dysentery.

In the usual use of the word, dysentery covers a wide field. However, it should not be used to indicate the ordinary acute diar-

rhea which is most frequently seen. True dysentery is of two types, the bacillary and the amebic.

The etiology of the true bacillary dysentery is the shiga bacillus though this may be accompanied by any of a large number of bacteria which may be preceded by putrefactive toxicity, inflammation or ulceration due to chemicals. The second variety is due to the entameba histolytica or tetragena and the diagnosis of this condition is determined by the finding of the entamebas in the stools. The bacillary type must be differentiated from a variety of intestinal troubles any one of which may produce the diarrhea.

The blood picture in both forms is that of a secondary anemia.

The cardinal symptom of both forms is a copious diarrhea with tenesmus and is usually accompanied by blood either occult or macroscopic. There may be intense abdominal pain with vomiting and fever.

The disease is confined largely to the large intestine although the small intestine may be badly inflamed during the course of the attack.

In the more severe types, the pathology will show intense inflammation or ulceration with necrosis or gangrene. The intensity of the symptoms, particularly the formation of gas, pain, the number of stools, and the amount of blood, will depend upon the severity of the case.

This condition must be differentiated from simple diarrhea, appendicitis, enteritis or enterocolitis, chemical or ptomaine poisoning, large ovarian cysts, and carcinoma.

The differentiation between the two types is by the microscopic examination of the stools and the finding of the shiga bacillus or the entameba histolytica.

The general management of these cases will require the best of hygienic conditions and, during the acute stage, rest in bed, careful attention to diet, and a water of undoubted purity. Barley water is one of the best articles of diet for acute conditions and later whey, albumen water, scalded milk, or thin gruel which has been cooked for several hours.

Treatment. Surgery will not be indicated unless there is perforation of the bowel. Heat will be necessary in these cases to maintain the body temperature which is usually subnormal, and this heat is best applied over the abdomen. In the application of this heat, nothing is equal to the visible light, which supplies not only heat but life-giving light rays.

Drugs for the bacillary form are principally chlorodyne No. 2, one tablet twice daily, for the pain, and copper arsenite 1/100 of a grain after each bowel movement. Ipecac has given splendid results both in small and in large doses, particularly if there is bleeding. Cantharis 1/100 of a grain three times daily is valuable if there is an accompanying vesicle tesnesmus.

The amebic type runs much the same course as the bacillary type but is much more likely to be complicated by a single hepatic abscess. In both instances, quinine enemas, in strength of 1:1000 have been found to be invaluable. Thymol 1:3000 may be added with benefit in some cases. Kerosene enemas using one pint each time are of value. For the amebic dysentery, nothing has been found to equal emetin, which can be given as emetin hydrochloride in doses of one-fourth to one grain intravenously or intramuscularly once or twice daily. Emetin bismuth iodid in daily doses of three grains in keratinized capsules until 36 grains have been given has been found successful in some cases. Each dose is preceded by morphin sulphate $\frac{1}{4}$ grain, which may be repeated in one hour if necessary for the nausea.

Castor oil in dram doses daily is to be recommended for its constipative rather than its laxative effect which occurs when larger doses are given. Physiological salt enemas should be given at frequent intervals if there is an accompanying vomiting or an inability to take the proper amount of liquids by mouth. In severe cases, normal physiological salt solution by hypodermoclysis will be needed.

The acute cases may recover in a few days but the chronic cases may have relapses at varying intervals for many years.

The physiotherapeutic treatment is general-visible light and actinic-ray treatments, the former given from ten to thirty minutes, the latter for one minute, increased daily to a period of ten minutes for each surface treated. These treatments should be given daily until there is very definite improvement. The visible light may be placed beside the bed of the more severe cases and used continuously or nearly so at a distance comfortable to the patient.

Infra-red rays may be used with benefit. Applications may be repeated as often as needed.

The prognosis, in the severe cases, is very grave but in the milder cases is favorable. Cases of undoubted amebic dysentery are rare in the temperate or cold climates. It occurs most frequently as the equator is approached, being essentially a tropical disease.

Dyspepsia.

Dyspepsia is another symptom which cannot be rated as a disease. While many patients suffering from dyspepsia have real pathology, the majority of them have unstable nervous systems.

Among the etiological factors will be found hyperacidity and gastric or duodenal ulcers which are treated more fully in their respective places. Indiscretions in diet, regardless of what they may be, are important etiological factors. Other diseases which should be studied as the etiology of dyspepsia are all inflammations,

both acute and chronic, of the abdominal cavity, particularly the stomach, intestines, pancreas, and gall bladder. Cancer must be looked for in the chronic dyspeptic. The symptom dyspepsia is found most frequently between the ages of twenty and forty although it may occur at any age.

The pathology will depend upon the disease producing this symptom.

The cardinal symptom is pain which will be accompanied by fermentation or acid food regurgitations which give a burning sensation about the heart known as "heart burn" and at times, where the fermentation is extreme, the pressure against the heart will temporarily interfere with the regularity of its contractions.

These symptoms are aggravated by eating anything which increases them and are relieved by anything which diminishes them. To make these statements more clear, ingestion of foods, particularly those containing sugars, is almost certain to make the symptom worse while vomiting or the ingestion of alkalies is almost sure to give, at least, temporary relief. Hot water, if taken in large quantities to produce emesis, gives immediate relief unless there is an acute dilatation of the stomach when it would also make the symptom worse. If the hyperacidity is severe, there will be a burning sensation the entire length of the esophagus and, many times, in the pharynx.

As the etiological factor is large, it must be thoroughly studied and every pathological condition eliminated before treatment is attempted. If no definite etiology can be found to account for the symptom, then the condition must be labeled neurotic as a provisional diagnosis. The various worries and anxieties of life must be considered.

The general management of these cases will revolve around the mental hygiene. Exercise in the open will be of distinct value in most cases, while a few patients will require rest in bed as the thing most needed for their particular mental make-up.

The diet should be light and easily digestible. Many of these cases do well on an exclusive milk diet, either sweet or as buttermilk, whey, or cottage cheese. If there is no definite pathology discernible, surgical treatment will not be needed.

Drugs are of comparatively little use except those known as stomachic tonics, i. e. cinchona, nux vomica, taraxacum, hydrastis, etc., and these should be given orally.

Of physiotherapeutic methods, general visible-light and actinic-ray treatment are the most useful. The slow sinusoidal current is valuable for immediate relief and for the accompanying constipation or ptosis. The slow sinusoidal current for these cases gives the best results when one pole is applied over the fifth and sixth dorsal vertebrae, the other over the epigastric region. The amount of current used will be all that the patient will tolerate without

discomfort. Vibration or concussion over the same vertebrae will give immediate relief as it dilates the pylorus, thus emptying the stomach, after which the patient should be given a glass of hot water in which may be dissolved a half dram of sodium bicarbonate or in its place a glass of potassium bicarbonate lemonade made as follows: A level teaspoonful of potassium bicarbonate is dissolved in a glass of non-sweetened lemonade.

The length of time the patient will require treatment is uncertain so is the prognosis both of which depend upon one's ability to remove the etiological pathology. These cases will, many times, tax one's diagnostic ability and will need careful study.

Dysmenorrhea.

Dysmenorrhea is not a disease, only a symptom. It may be functional or neurotic in type due to an endocrine dysfunction. It may be a congestion or an obstruction. If from the latter, it will be either from the position of the uterus, the smallness of the cervical canal, or by the shedding of the endometrium en masse. If from the former, it may be due to a hyperplastic endometritis. Besides the types already given, the etiology is unknown.

Its pathology is also described in the types given.

Its cardinal symptom is pain coming on at various times within a few days before the flow, and terminating with the beginning of the period, or it may begin with the flow and terminate only with its subsidence. Occasionally the pain is most severe midway between the periods.

While its diagnosis can usually be made upon the history of the case, it must be differentiated from every other pelvic condition which might cause pain and this means any inflammatory, infective, or obstructive condition within the pelvis.

The general management of these cases will demand as good a hygienic living as possible, plenty of outdoor exercise, together with plenty of regulated rest and a liberal diet consisting, however, mostly of fruits and vegetables.

Surgery is of little use in these cases unless there is very marked malposition, malformation, or obstruction due to tumors or a very narrow cervical canal, which, however, is seldom responsible for the symptoms it is supposed to cause.

Drugs of the sedative type occasionally are of value, while those that produce hyperemia of the pelvic viscera increase the congestion and consequently the pain. Opiates are seldom permissible in the treatment of these conditions, as there is a grave danger of habit formation. Dilatation and curettage are of no practical value in the treatment of this condition.

Of the physiotherapeutic measures valuable in these conditions, one should consider galvanism, faradism, rapid sinusoidal and high-frequency currents, also infra-red, visible-light, and ac-

tinic rays. The latter are the most useful and should be given as a daily general treatment for a few days preceding the expected period and throughout its duration.

Galvanism is useful for the hyperplastic endometritis when used with a copper electrode, as a positive pole, introduced into the uterus, and the negative pole over the hypogastrium. The copper electrode should be as large as may be introduced without pain. The negative electrode should be of composition metal, about four by six inches in size, and well covered with cotton kept wet with a sodium-chloride solution. Use as much current as the patient will tolerate, usually from five to twenty milliamperes for about fifteen minutes twice weekly. Some cases do well if only a copper-ball electrode covered with cotton and wet with a two per cent copper-sulphate solution is used in the vagina, pressed against the cervix. This method is advisable in young women. These treatments should be given during the interval.

Faradism, or better still, rapid sinusoidal current, is applied with an uncovered ball electrode in the vagina and the indifferent pole over the third and fourth lumbar vertebrae. Both currents are used during the interval for their stimulative action.

Case No. 427. Female, age 23. Periods about every seventy days, lasting six days and very painful for the first three days. Last period November 22, 1917. Began actinic-ray treatments December 17, 1917.

DATE	VISIBLE LIGHT	ACTINIC RAYS		SPINAL VIBRATION	CLINICAL FINDINGS
1917	Duration of Treatment	Air-cooled Lamp		Duration of Treatment	
		Duration of Treatment	Distance from Patient		
Dec. 17	10 min.	3 min.	20 in.	5 min.	Less pain.
Dec. 18	10 min.	4 min.	16 in.	5 min.	
Dec. 19	10 min.	5 min.	14 in.	5 min.	
Dec. 20	10 min.	5 min.	12 in.	5 min.	
Dec. 21	10 min.	6 min.	12 in.	5 min.	
1918					
Jan. 4	10 min.	7 min.	12 in.	5 min.	More pain, but flowing. Interval, 53 days. Flowing; slight pain. Interval, 38 days. Flowing; slight pain. Interval, 26 days. Flowing; slight pain. Interval, 35 days. Flowing; no pain. Interval, 28 days.
Mar. 6	10 min.	8 min.	12 in.	5 min.	
Mar. 14	10 min.	10 min.	12 in.	5 min.	
April 26	15 min.	10 min.	12 in.	5 min.	
May 21	25 min.	10 min.	12 in.	5 min.	
June 28	10 min.	10 min.	12 in.	5 min.	
July 26	10 min.	10 min.	12 in.	5 min.	

DIAGNOSIS: Dysmenorrhea, Hypothyroid.

Diathermy is used with one electrode in the vagina the same as for the rapid sinusoidal current, the indifferent pole over the sacrum or hypogastrium, depending upon whether it is desirable

to drive the heat anteriorly or posteriorly. In young girls, it is best to use one electrode of composition metal, about four by six inches, over the sacrum, the other electrode, the same size, over the hypogastrium, thus gently heating the pelvic tissues for twenty to forty-five minutes. These treatments should be given daily for the week of the period.

Complications which may accompany dysmenorrhea have already been given under the differential diagnosis.

These cases require treatments for months which are usually given before or during the period.

The prognosis is good as to life, but unfavorable as to complete relief without recurrence, which may be caused by chilling or getting the feet wet at the time of the period.

Ecchymosis.

Ecchymosis is usually produced by external violence, although at times it is due to a weakening of the vessel walls as in purpura hemorrhagica and hemophilia neonatorum.

Physical measures offer much for the cases brought on by violence, but very little for the congenital purpura cases. The sooner the ecchymotic cases are treated after injury the better and the quicker the result.

Visible light is most effective in these cases, but should be coupled with massage during the light treatment. The massage should be mild stroking with the venous circulation. This quickly removes the extravasated blood. Mild vibration, using a soft rubber vibratode, is many times of value. Infra-red rays are of distinct value.

Eczema.

Eczema is an acute or chronic inflammation characterized by burning and redness of the skin in all shades from pink to purple. Most cases have itching and moisture exuding from the vesicles after they rupture. A few cases do not have vesicles and this type is known as dry eczema. This disease constitutes about forty per cent of all dermatological lesions.

In pathology, it is a simple inflammation of the skin, usually of the superficial layers, and is not contagious or infectious.

Its diagnosis is usually made by excluding any definitely known disease of the skin, but especially those skin troubles which form papules, vesicles, or pustules, and whose discharges form crusts. A short way to characterize this disease would be to say that it is all skin diseases not otherwise diagnosed.

While it is usually found on the hands, face, or legs, it may come on any portion of the body or cover the entire body.

A large number of cases of eczema are produced by external irritants such as are used in the various trades and manufactures. These irritant eczemas usually clear up promptly upon removal of

the active etiology. They are usually acute unless the work is continued which, of course, keeps up the irritation and produces a chronic form. Those not due to occupation usually have as their underlying etiology a disturbed alimentary function.

The general management of these cases consists of strict hygiene, which does not permit water to be used except the amount absolutely necessary for cleanliness. Exercise in the open will help to correct any disturbance of the digestive tract, while diet stands as one of the main factors in the treatment of this disease. The heavy starches and sugar should be restricted or eliminated from the diet, as should all the stimulative articles of diet. A simple diet of milk or of vegetables and fruit should be adhered to, if at all possible, and the bowels should be kept free but not loose.

There is no surgical treatment for this disease. Drugs useful internally are arsenic, sulphur or rhus tox, in small doses, 1/100 to 1/1000 of a grain. Sea water in doses of from one to twenty mls. given subdermally twice weekly is of definite value. If there is a determining cause which can be ascertained, it should be treated, or if possible, removed.

The local treatment will consist of antidotes to known irritants followed by soothing or anodyne applications, olive oil being one of the best of this type. Powders should not be used, as they increase the crust formation and allow bacterial development.

In physiotherapy, actinic rays and visible light, particularly the former, are of the utmost value and, many times, all that is necessary in addition to the general management of the case. An acute case should be well in from two to four weeks and the more chronic cases in two or three months.

For small areas, use the water-cooled lamp at a distance of one inch for one to five minutes. The idea is to blister the diseased area so as to remove the epidermal layer of the skin. For large areas, use the air-cooled lamp at a distance of two to fifteen inches for one to ten minutes. The actinic-ray treatments should be daily until there is definite improvement, then three times a week; never less than twice a week. In some cases, especially if anemia accompanies, it is best to give the general visible-light and actinic-ray treatments as well as the local.

There are seldom any complications worth mentioning.

The prognosis is good, although recurrences are common.

Case No. 109. Female, age 59. She has had eczema the greater part of the time since she was four years old, and has been treated more or less all that time. There was scarcely a part of her body that was not eczematous. Her right hand was blistered, cracked, and bleeding; her face was covered with vesicles, as were her feet.

June 23, 1916, she was given a four-minute actinic-ray treatment with the air-cooled lamp. Her next treatments were June

26th, 29th, July 3d, 6th, 10th, and 14th, at which time she was blistered badly, so had no further treatments until August 3d. Another was given August 9th, and the last August 18, 1916, when she was free from eczema. No local treatment of any kind was used. This case was reported well in 1918.

DIAGNOSIS: Eczema.

Case No. 330. Female, age 20. Came to us November 27, 1917, with eczema marginatum in both groins. The itching was intense and she had scratched portions of the area until they bled. Her treatments with the actinic-ray water-cooled lamp were from two to four minutes, every second day. No itching after the third treatment. At the end of one month she was well. Calendula ointment was used after the treatments to reduce the burning and the friction.

DIAGNOSIS: Eczema, marginatum.

Empyema.

Empyema is an accumulation of pus in a normal cavity, although usually it refers to the pleural cavity. In this case it is secondary to an acute or chronic pleuritis with effusion which in turn may be secondary to any inflammatory disease of the lungs. The inflammation spreading to the pleura produces a serous or serofibrinous exudate, which may become infected either hematogenically or by direct contact with various pus-producing bacteria which may be either streptococci, staphylococci, pneumococci, colon bacilli, tubercular bacilli, or the typhoid bacillus of Eberth. The most common is the pneumococcus, which causes about fifty per cent of the cases.

The pathology of the pleura is that of a dense thickening or, at times, an edematous condition of this membrane. The empyema may be walled off to one particular portion of the plura or it may involve the entire cavity.

The cardinal symptom of this disease is dyspnea. The symptoms come in about the following order: chill, fever, pain in the affected side, a rapid pulse, and a decided anxiety due to the dyspnea. If the disease is allowed to progress for a month or more, the patient becomes emaciated, weak, morose, and there is anorexia. The temperature varies from 101° to 105° F.

The blood picture is one of polymorphonuclear leukocytosis.

The differential diagnosis will be from all other diseases of the chest, including both the benign and the malignant. These will include fibrinous pneumonia, heavy pleural thickening, hydrothorax, subdiaphragmatic abscess of the liver, lung abscess, metastatic pleuritis, bronchiectasis, tuberculosis, aneurism, or carcinoma and sarcoma of the lung or mediastinum, either primary or secondary. A roentgenogram will aid materially in clearing up the diagnosis.

The general management of the case will consist of frequent sponge baths, rest in bed, and a light diet usually of milk or fruit juices until absorption or drainage takes place.

As to treatment, surgery must always be considered, but should not be employed until other measures have been tried for a few days at least.

Among the drugs most useful for this condition iodine stands pre-eminent and should be given intravenously in the form of sodium iodide, 32 grains, with guaiacol $\frac{3}{4}$ of a grain. Strychnine nitrate may be indicated in some cases and may be given either internally or subcutaneously in doses of 1/100 to 1/50 of a grain three times a day for stimulation.

Local applications of any drug are of little value in this condition, although magnesium sulphate, as a wet dressing over the entire thorax, will relieve the pain. This solution should be an ounce to a pint of water.

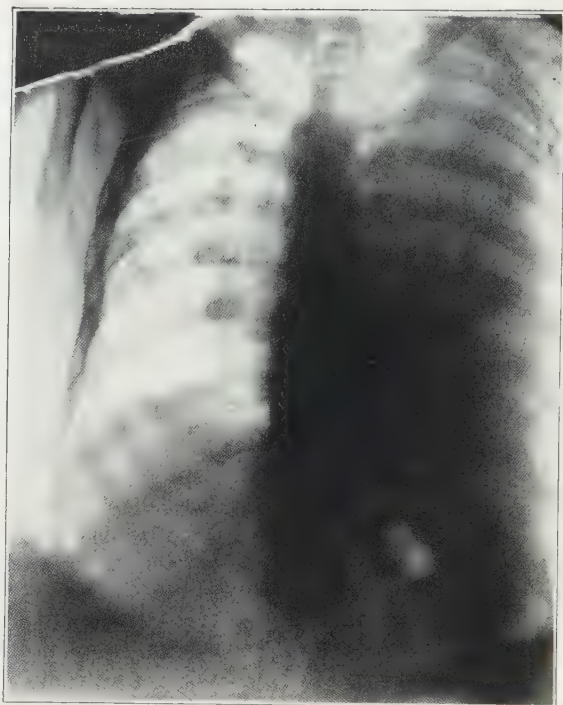
The physiotherapeutic treatment consists of the use of the visible light for one hour or more twice daily and actinic rays just to the point of hyperemia, which is about one minute at a distance of twenty inches. The actinic rays may be given twice daily for a few days. After three or four days, decided absorption will usually take place when it will be necessary to shorten the time of the treatments or discontinue them altogether for a few days, after which they should be given at longer intervals and for shorter periods, about one-half hour with the visible light, and from one to ten minutes with the actinic rays, the latter increased about one minute daily. If adhesions of the pleura have occurred, it may be wise to use diathermy through the chest wall at the point of adhesion. This treatment, however, is to be given after the absorption of the exudate. One applicator of composition metal about four by six inches is placed posteriorly and one anteriorly over the region of the adhesion. The amount of current used will depend upon the size of the applicator and the thickness of the chest, but must not be more than will be comfortable to the patient.

Complications encountered will be those of pus absorption and infection in any portion of the body. These are likely to involve the heart, the kidneys, joints, and abdominal viscera.

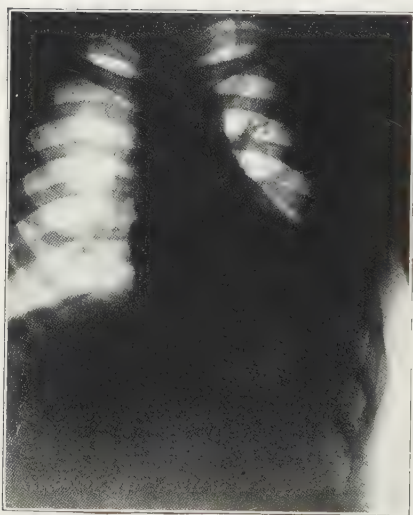
The average length of time these cases should be under treatment will be from two to four months unless there is surgical drainage, then they may require treatment for an undetermined length of time, as many of these sinuses refuse to heal.

The prognosis in the average case is good.

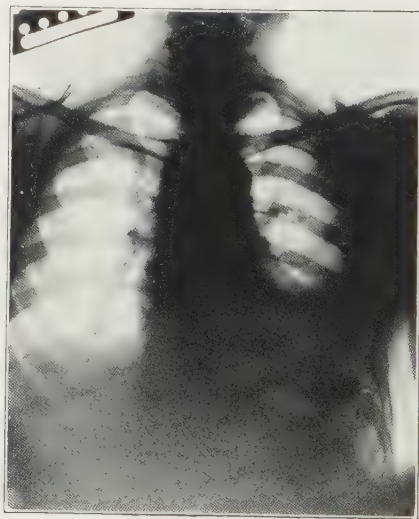
Physiotherapeutic methods must not be used too long, or in other words, the surgical treatment must not be too long delayed. This will depend entirely upon the progress of the case. If the absorption is steady, and this is to be determined by percussion and roentgenograms, the physiotherapeutic treatments should be continued, otherwise surgical drainage should be resorted to, after



Empyema showing left pleura cavity filled.



Appearance after two weeks of visible-light and actinic-ray treatments.



Appearance four weeks after starting treatment.

which the general visible-light and actinic-ray treatments should be resumed.

Case No. 12B. Male, age 45. Came for treatment September 14, 1921. Four days previous to this time he had exercised until wet with perspiration, after which he rode for several hours in an open car. This ride was followed by a chill and a rapid rise in temperature to 104.5° F., pulse 130, which was followed by difficult breathing.

Physical examination at this time showed dullness over the entire left side with elimination of heart and breath sounds. (See roentgenograms, Figure 1, Plate XLV.) He was placed under continuous visible light (1000 watt bulb) with actinic rays from the air-cooled lamp one minute twice daily. On the fourth day the absorption was so rapid that it was necessary to change the continuous visible light to one hour daily, the actinic-ray treatments being increased one minute daily up to ten minutes. At the end of the second week (see Figure 2, Plate XLV) the roentgenogram showed rapid absorption. At the end of the second month, the fluid was all absorbed, although there were a few adhesions opposite the heart. Diathermy through this area cleared the case of all symptoms. (See Figure 3, Plate XLV.)

The case has remained well to date, June, 1926.

DIAGNOSIS: Empyema.

EMETIN HYDROCHLORIDE*

T. HOWARD PLANK, M. D.

Cephaelis ipecacuanha was first discovered in the seventeenth century and was at that time used for dysentery. Its native habitat is Brazil. Its physiological action is irritation of the pneumogastric nerve and, through it, the organ it supplies, increasing their secretions. Its action is particularly severe on the stomach where it produces intense and persistent nausea, retching, and vomiting. It has been used since the time of its discovery to produce emesis and, in small doses, to cure it. Its active principal is emetin, the use of which has been varied.

A lethal dose of emetin will produce paralysis of the muscles of respiration through the vagi. The drug is eliminated by the gastrointestinal mucous membrane and is found in all secretions. Bass and Johns recommended it for the entameba, which is destroyed in a solution of 1:10,000 and which accompanies pyorrhea. It had previously been used for amebic dysentery.

The newer use of emetin is for hemorrhage, although the crude drug has been used by the Homeopathic profession in small doses for capillary bleeding for many years. They could not employ it for the more severe hemorrhages because they could not give it in sufficient doses by reason of its emetic qualities. With most of

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these removed in the production of emetin hydrochloride we can now use it in large doses and for very severe hemorrhages from any portion of the body except the large vessels, and its action is manifest within a few minutes if given intravenously.

For capillary bleeding emetin can be given by mouth or hypodermatically, but for serious bleeding it must be given intravenously in minimum doses of 1 grain of emetin hydrochloride. It may be repeated in twelve hours if necessary, although usually the interval is twenty-four hours, and the dose should be repeated daily for three to six days, and it makes but little difference whether the bleeding comes from a pulmonary lesion, a gastric ulcer, a fibroid uterus, a papillomatous bladder, a carcinomatous area or from a simple injury. Emetin is used with equal success for epistaxis.

Following electrocoagulation of malignant growths, it is indispensable to control the hemorrhages that sometimes occur when the slough separates, and we use emetin to control the bleeding of hemophiliacs.

For children the dose must be gauged according to Young's scale for the various ages, but for the average adult we give one grain intravenously and repeat every twenty-four hours for three to six days, although occasionally we repeat in twelve hours, and we have given it up to three grains at a single dose, although one grain is usually sufficient. Bleeding usually lessens in a few minutes, with complete cessation of all oozing in a few hours. If emetin hydrochloride is used, there is seldom any nausea and, when present, it will subside in a half hour's time. There is no remedy in use today that is superior to emetin and none to our knowledge that even equals it as an antihemorrhagic.

Endocarditis.

Endocarditis is an inflammation of the lining of the heart and its folds over the heart valves, with vegetative growths thereon. As a rule the endocardium covering the valves is first to be affected.

Endocarditis may be either acute or chronic. There are rare cases which are known as malignant endocarditis which are in reality a rapid ulceration of the valves with a fatal prognosis.

The etiology of a case of endocarditis is an infection, although the exact bacteria has not been isolated, as many varieties have been found.

Endocarditis as well as other inflammations in, on or about the heart usually occur during an attack of an infectious disease and the damage done during the acute attack may persist after the attack has subsided. Such damage usually persists during the life of the individual and may again become active as he advances in years.

Among the acute diseases which are active etiological factors

are: acute rheumatism, acute tonsillitis, diphtheria, influenza, scarlet fever, pneumonia, septicemia or pyemia, erysipelas, gonorrhea, syphilis, acute infections following traumas, etc.

Symptoms. In the early stage of the infection the symptoms are indefinite, although if a patient with an acute infectious disease is carefully watched a gradual weakening of the heart impulse will be noted, together with a slight murmur. With the growth of vegetations or the development of ulcerations, a pronounced murmur will be heard and this is the cardinal symptom of an advanced case. Once this stage is reached, the condition is permanent, although not necessarily progressive.

The complications are: its progressive character, the involvement of the myocardium or the pericardium, and the late involvement of the coronary vessels.

The treatment is largely preventive by keeping the patient, suffering from an acute infection, at rest in bed with injunction to use the least physical effort possible during the height of the attack or for some days thereafter.

The diet should be light but nutritious and easily digested. The quantity should be limited and given at frequent intervals. Overloading the stomach is to be avoided. An ice bag over the heart helps to steady the pulse, is soothing to most patients, and lowers the temperature at which bacteria thrive best.

Potassium is a good mild diuretic. The skin should be kept active by giving frequent sponge baths and magnesium sulphate added to the water is appreciated by the patient. Sodium iodide and guaiacol or sodium salicylate given intravenously are of definite benefit.

From the physical-therapeutic side of the treatment, general visible-light and actinic-ray treatments are invaluable not so much for the cardiac inflammations, as a remedy for the infection which is the etiological factor.

Diathermy through the heart is a good remedy for the heart infection itself, but must be used in moderation and for shorter periods of time than the average treatment requires. For the average case use 4 by 4 inch electrodes, front and back, for a period varying from ten to thirty minutes, average twenty minutes, with a milliamperage varying from 300 to 500. These treatments should be given daily.

The prognosis is favorable as to life, but if the valves are damaged they will remain so.

The prognosis of the malignant or rapidly ulcerating case is usually hopeless.

Enuresis.

Enuresis is due to a variety of causes as an adherent foreskin, either in male or female, intestinal irritation from worms or from colitis. Indigestion is a frequent cause and it is a frequent

accompaniment of neurosis. Over-fatigue is a common etiological factor. When occurring in elderly people, it is usually due to pressure paralysis.

In diagnosing this condition, a thorough physical examination will be necessary to determine, if possible, the etiological factor in each particular case.

There is no definite pathology or bacteriology connected with these cases and the cardinal symptom is the loss of control, usually nocturnal.

The general management of the case will consist in restricting liquids in the latter part of the day and plenty of exercise in the fore part of the day, with comparatively little late in the day or evening. The child should be encouraged to sleep during the day, if at all possible, thus reducing the amount of evening fatigue. The evening diet should be simple, the heavier meals should be at noon or in the morning. The bowels should be kept regulated, as constipation is sometimes a very important factor in the etiology of these cases.

Phimosis is a frequent cause of this condition and is, therefore, surgical. Hemorrhoids, fissures, and rectal papilla are etiological factors and are also surgical.

Drugs have but little effect upon this trouble, although occasionally epinephrin is of value. Strychnin arsenate, 1/200 of a grain, or nux vomica, 1/100 of a grain, is at times useful for the digestive disturbances.

Of the physiotherapeutic modalities, the slow sinusoidal current or superimposed wave is probably the most valuable. It is given by placing one applicator over the lower lumbar region, the other above the pubes or over the perineum, using a current as strong as the child will permit without discomfort. Intra-urethral applications of electricity should not be permitted, as they are unnecessary.

Punishment does very little to correct this habit, which it is to a great extent, and the management of these cases, many times, requires the utmost tact and perseverance on the part of the parent as well as the medical attendant.

The average length of time these cases will require treatment is from a simple operation and its after care of a few days, to months of the most painstaking research.

The prognosis is almost invariably good unless the condition is due to a pressure paralysis which cannot be removed, and as this gives an increasing incontinence, it is not to be classed with nocturnal enuresis.

Epistaxis.

Epistaxis and all small local bleedings can be readily controlled by an intravenous injection of one grain of emetin hydro-

chloride (adult dose) intravenously and the application locally, on cotton or gauze, of oleum terebinthinae (20%) in oleum olivae.

This condition must be differentiated from pulmonary, gastric, or esophageal hemorrhages.

Epididymitis.

Inflammations of the epididymis have as the usual etiological factor Neisserian bacilli, although at times the etiological factor may be tubercular, malignant, or an infection of any of the ordinary infective bacteria. Traumatism is, at times, an etiological factor.

The pathology consists of an infection of any pus-producing bacteria which usually goes on to obstruction of the lymph circulation with lymph edema and abscess formation. Orchitis should be considered at the same time with epididymitis, for the etiological factors are the same. The pathology differs only in location.

The cardinal symptoms are pain, distension, and edema of the epididymis and surrounding structures.

There is no definite blood picture.

In diagnosis, inflammations of the epididymis or testicle must be differentiated from scrotal hernia, syphilis, tuberculosis and malignant diseases, as carcinoma, sarcoma, teratoma, but as previously stated, these cases are usually caused by gonorrheal infections. If tubercular, there will be nodules along the vas deferens as well as on the surface of the testicle itself. As the disease spreads inward along the vas, the seminal vesicles and prostate will also become involved. The nodular masses usually differentiate tuberculosis from sarcoma of the prostate gland, although if the nodules in the prostate gland are of stony hardness, the condition is probably a primary carcinoma.

The general management of epididymitis of gonorrheal origin is to support the scrotum and its contents. There should be absence of exercise, although rest in bed is seldom needed for more than a few days at most. The diet should be simple and the bowels should be kept loose. Surgery is resorted to frequently, but is usually unnecessary. Internally and subdermally drugs have but little effect upon this disease, while the intravenous use of sodium iodide, 32 grains, and guaiacol, $\frac{3}{4}$ of a grain, has a very decided effect, but actinic rays from the quartz mercury-vapor lamps, both local and general, are our most useful agent.

Local treatment should be given with the water-cooled lamp to the point of blistering, while the general visible-light and actinic-ray treatments should be given for their physiological action. If it is impossible to use actinic rays, the scrotum should be strapped with ZO adhesive; first shave the skin, then use a half-inch strip of adhesive around the scrotum close to the body, then apply half-inch strips, starting at the first strip, going down over the scrotum

and up to the circular strip, using pressure enough to squeeze most of the blood and lymph out of the tissues. Continue these strips until the scrotum is entirely shingled. This will give immediate relief and allow the patient to go about his ordinary duties.

If pus has formed before the case is seen, it must be evacuated by simple drainage. Packing and irrigations are unnecessary.

The inguinal glands at times become involved in the infective process, producing the well known bubo. This should be lanced the same as an abscess of the vas or testicle, and the physiotherapeutic treatment outlined for the epididymitis should be followed for the inguinal lymph glands.

Posterior urethritis and cystitis are common complications.

For tubercular epididymitis the same treatment as outlined above is sufficient, except that the seminal vesicles and prostate should be treated through a proctoscope, using the water-cooled quartz mercury-vapor lamp. These treatments should be given daily in three locations for one or two minutes each, until definite relief is established, then three times a week.

The average case of gonorrheal epididymitis should be well in from one to four weeks; if tubercular, in from three to twelve months.

The prognosis in both cases is good as to life, although both will probably render the patient sterile upon the affected side. This sterility is due to the occlusion of the lumen of the vas.

A malignant epididymitis or orchitis should be treated as other malignant troubles by extirpation of all the diseased tissue and its metastases or the latter may be treated by X-ray for the deep glands, or radium for the superficial glands. Radium is used in 50 mg. packs; the screening should be leather 2 cm., lead 2mm., brass $\frac{1}{2}$ mm., and rubber 1 mm. The length of time should be from eight to twelve hours in each location.

Diathermy is of value in these cases if carefully administered. One electrode should be placed anteriorly, the other posteriorly on the scrotum and care should be taken that they are both the same size and that their outer edges are equidistant. The amount of current will be the patient's tolerance which will be about 300 milliamperes. These treatments should be given daily.

Professor Carl R. Moore of the University of Chicago, (Am. Jour. Anat. Nov. 15, 1924, Page 351) says, "After exposure to 47° C. (117° F.) for five minutes the testis, at the end of five days, is devoid of tubules that approach normal ones." As men will not stand 117° F. there is but little danger of damage, however, the fact that heat damages the spermatic tubules should put one on guard.

Case No. 486. Male, age 31. Came for treatment November 11, 1922. He gave a history of a Neisserian infection two months previous to this date. Physical examination showed a large, ten-

der, boggy mass in the right scrotum with slight fluctuation, which on transmitted light proved to be a hydrocele.

His first treatment was a three minute application of actinic rays from the water-cooled lamp and an intravenous injection of sodium iodide and guaiacol (32 and $\frac{3}{4}$). He was given like treatments daily for 5 days after which he was obliged to be out of town for two weeks. When he returned he took 7 additional treatments. These were given every second day. At the end of the second series of treatments the scrotal contents were apparently normal. The hydrocele was tapped while taking the third treatment, the quantity of serum removed was four ounces. It did not refill.

DIAGNOSIS: Epididymitis and Hydrocele.

Erosion and Ulcerations of the Cervix.

An erosion of the cervix is but a superficial denudation of the epithelial layer of the vaginal mucous membrane, while an ulcer of the cervix is the destruction of the underlying tissues as well as the epithelial layer. Many of the cases which are called erosion or ulcer of the cervix are in fact eversion of the endocervical tissues due to lacerations.

Eversions are strictly surgical and should not be classed with erosions or ulcerations. Ulcerations may be simple due to irritants such as lysol, carbolic acid, mercuric bichloride etc., which at times are used for douching purposes. Deep simple ulceration may also be caused by the use of pessaries of various kinds and types. Other ulcerations which must be taken into consideration in the diagnosis of a case of cervical erosion are tubercular, syphilitic, chancroidal, and cancerous. The tubercular ulcerations are exceedingly rare and must be diagnosed by an examination of scrapings from the involved area. Likewise a syphilitic ulcer as a primary lesion will yield spirochetes in a dark field examination. Secondary and tertiary lesions must be diagnosed by a Wasserman, clinical manifestations, and tissue examination.

Chancroidal ulcerations of the cervix are similar to those in any other portion of the body and will yield Ducrey bacilli.

The malignant ulcerations are readily diagnosed by a microscopic examination of a removed specimen. This, however, should be done by a competent pathologist otherwise mistakes are likely to occur. If it is impossible to obtain an examination of the specimen removed, a ten per cent solution of copper sulphate applied to a malignant ulcer will cause it to bleed readily while if it is a simple ulcer it will produce a faint white coating and no bleeding will result. This is fairly accurate.

Treatment. For the tubercular ulceration, the chancroidal ulceration, and the simple ulceration or erosion, the application of the actinic rays from the water-cooled lamp is usually all that is needed. The actinic-ray treatments should be given through a

vaginal speculum using a proctoscope to avoid blistering the vulva. These treatments should be of one minute's duration and the frequency should be daily to three times a week. Healing should start in a few days and be complete for the average case in from two weeks to a few months. Simple and chancroidal ulcers should be healed in two or three weeks, while the tubercular ulceration may require several months. The syphilitic ulceration will require anti-syphilitic treatments.

Malignant ulcerations of the cervix will require an application or rather several applications of radium. If the ulceration is very extensive, first electrocoagulate as much tissue as possible with the d'Arsonval current, this to be followed by the application of radium needles (See cancer of the cervix) introduced into the surrounding tissues and within the uterus. This, in turn, should be followed by both general and local actinic-ray treatments the former for their systemic effect and the latter for their bactericidal action.

Drugs have but little effect upon malignant ulcerations.

The prognosis is good for the tubercular, the chancroidal and the simple ulcers, less favorable in syphilitic and least favorable in malignant.

Case No. 367. Female, age 26. Married for one year, but never pregnant, although she desired to be. Examination showed an acid leucorrhea which irritated the skin about the vulva. An area of the cervix about the size of a quarter was eroded and bled easily when touched. This bleeding was controlled immediately when a 10-per-cent solution of copper sulphate was applied. The husband was found to be normal and his spermatozoa were normal.

We began treatments with the actinic rays on August 25, 1917, giving a two-minute treatment, which was increased to ten minutes thrice weekly. Magnesium-sulphate douches were used. On January 2, 1918, she reported herself pregnant.

DIAGNOSIS: Erosion of Cervix.

Erysipelas.

Erysipelas is a highly contagious and infectious disease affecting both the skin and the subcutaneous structures.

The bacteriology is streptococcus erysipelatus.

Its pathology is an inflammation of both the skin and the underlying structures which become edematous giving a sensation of thickening or hardening to the involved area which is raised above the surrounding tissues.

The cardinal symptoms are a chill, followed by a sharp rise in temperature and an increased pulse rate. There is an immediate reddening of the skin, the infiltration and edema appearing a few hours later. From the point of original involvement, the disease spreads rapidly hour by hour from any or all margins of the orig-

inal lesion. The patient is made violently ill by the absorption of toxins, the products of the bacterial invasion. While erysipelas usually occurs on the face, neck, and head, it may occur on any portion of the body. Given the above symptoms the diagnosis of erysipelas should be easy. However, it must be differentiated from simple erythema, scarlet fever, and from dermatitis due to poisonous substances and especially from tooth or sinus infections.

These cases require absolute rest in bed, on an exceedingly light diet or what is better for a few days, a strict fast.

Treatment. Surgery is not required unless there is abscess formation which is exceptional. Drugs internally are at times necessary to support the heart and nervous system. Here strychnin is one of the best drugs to be used.

Subdermally, morphin may be necessary at times to obtain the necessary rest and quiet. Intravenously, sodium iodide 32 grains and guaiacol $\frac{3}{4}$ of a grain proves efficacious in most of these cases. Drugs used locally are of little benefit, however, the saturated solution of aluminum acetate is at times of value so is lactic acid buttermilk. Magnesium sulphate in a saturated solution is at times of very definite value. One of these should be used continuously as a wet dressing.

Erysipelas, which is a highly contagious and infectious disease, is liable to many complications. Infections of the heart are the most common. These are most likely to be in the form of endocarditis or myocarditis. Infection of the central nervous system is a rare complication but a very serious one and because these complications occur in the late stages it is necessary to gain control of this disease as early as possible.

If it is at all possible to give an actinic-ray treatment to these patients, this should be done at the earliest possible moment as a single treatment usually stops the disease from spreading while if it has been running for several days it may require many treatments and two or three weeks of time to accomplish the same results.

In handling these cases, it must always be remembered they are highly contagious therefore one should not do surgery or obstetrical work while attending a case of erysipelas.

While the prognosis is usually good, these cases must be controlled early or complications may arise which make it serious and unfavorable.

Recurrences are common.

Case No. 181. Male, age 46. Had a chill and a sharp rise of temperature on April 23, 1923. I was called two days later to find him delirious with a temperature of 105° F. A part of the left side of his face was edematous, red, and elevated above the surrounding tissue. The margins of the inflamed area were well

defined. I installed a water-cooled lamp in his room and gave him one minute treatments twice daily at a distance of one inch. In addition to the actinic rays he was given daily intravenous injections of sodium iodide 32 grains and guaiacol $\frac{3}{4}$ of a grain. He was given fifteen injections and actinic-ray treatments with complete recovery.

DIAGNOSIS: Erysipelas.

Erythema.

External erythemas are symptoms of many types of disease and varied as to location. They are from the simplest redness of the skin to inflammatory changes followed by destruction. They range from the faint redness of blushing to the desquamative redness of scarlet fever. They may accompany periostitis, an incarcerated hernia, or a focal infection. Irritants and toxic substances will produce them. Among the most common of these is the ivy poisoning due to the rhus toxicodendrum. The erythema of a rhus poisoning and a herpes labialis are very similar in appearance.

A condition varying as much in type as an erythema does, necessarily has a very wide etiology which is entirely too long to be taken up in an article of this kind and the pathology is as varied as the etiology.

The cardinal symptom is the redness which may be simple and smooth or it may be vesicular. At times bacteriological invasion will cause the vesicles to become more or less filled with pus and if the infection spreads below the surface, there will be a certain amount of edema or fluctuation beneath the skin. Again the cardinal symptom is the redness which may or may not be accompanied by vesicles.

The general management and the treatment of erythema cases covers too wide a range to be given in detail here, but almost without exception all types of erythema can be treated with general or local actinic-ray treatments.

Complications are necessarily many.

The average length of time these cases require treatment will depend largely upon the etiology and the practitioner's ability to remove it.

The prognosis in most of the cases is good, although in scarlet fever and other infectious diseases the prognosis may be very grave.

Fatigue.

Fatigue is only a symptom, therefore the underlying etiology must be carefully searched for and considered when treating this symptom. Usually it will be found that there is some toxic element either from food poisoning or intestinal absorption. Overwork, worry, or any of life's anxieties may tear down sufficient tissue to

produce the symptom, fatigue. Many of the focal infections, especially those of long standing, may give this symptom and if the resistance of the individual is fairly good, it may be without any accompanying localized pain. Fatigue produces a susceptibility to infection.

In many of these cases, exceptional diagnostic acumen will be needed to find the underlying etiology if that is at all possible.

The general management of this condition consists of a regulated exercise, a sufficient amount of rest, and a diet nearly free from proteid matter. Bowels must be kept regular but not loose. The treatment may be surgical if the foci of infection can be found.

Drugs, especially those given intravenously, may be of value among which will be found iron cacodylate $\frac{1}{2}$ of a grain, sodium cacodylate 2 grains and nuclein solution 16 minims or sodium iodide 16 grains and guaiacol $\frac{3}{8}$ of a grain. Subdermally, iron citrate $\frac{3}{4}$ of a grain, sodium arsenate $\frac{1}{64}$ of a grain, nuclein solution 10 minims and distilled water 15 minims will be of value.

Physiotherapy renders efficient aid in the treatment of this condition; particularly is this true of general visible-light and actinic-ray treatments. If the foci of infection is found, an application of actinic rays from the water-cooled lamp to the surrounding area will be of definite benefit.

These areas should be treated daily with the actinic rays from the water-cooled lamp for a period of time varying from a few seconds to two minutes, depending upon the area involved. The shorter period of time should be used for apical infections, while the longer periods of time should be used for infections about the vagina or skin.

Both progressive muscular atrophy and pernicious anemia give the symptom fatigue in a marked degree and in these diseases it is not amenable to treatment. Secondary anemia, regardless of its cause, has fatigue as an early symptom, particularly so if the hemoglobin is below fifty per cent.

Felons.

Felons are usually infections of the periosteum and of the underlying bone although occasionally of the superficial tissues.

The etiological bacteriology of these cases is usually staphylococcic although occasionally streptococcic. Other bacteria may be associated.

The pathology is a typical infective process with continued destruction of both bone and soft tissue until the pus is relieved either by drainage or by destruction through to the surface. The latter, however, should never be permitted if the case is seen at all early. It should be lanced immediately not to the periosteum but through it to the bone itself, allowing free drainage. If this

is not done, there will develop a typical osteomyelitis with destruction of the bone and deformity of the finger. This disease is most common upon the fingers and has trauma as a primary etiological factor.

The disease must be differentially diagnosed from other inflammatory infections about the fingers, but usually the rapid onset, the intense pain, and swelling over the site will be sufficient to make a proper diagnosis.

The general management and treatment of this condition are one; immediate opening of the infected area to produce free drainage and the destruction of the bacteria. Wet, antiseptic dressings of a saturated solution of aluminum acetate or a solution of magnesium sulphate, one ounce to a pint of water, either of which should be used continuously, will give a great deal of comfort to the patient but the best local treatment after drainage is actinic rays from the water-cooled lamp for one or two minutes. These treatments should be given daily and relief will be had within a few hours after the first treatment.

Complications arise only when the disease is permitted to progress. If unopened, the infection may extend upward through the hand and into the arm, thus rendering a very serious prognosis.

The average length of time these cases will require treatment will depend upon how early and how vigorously the case is treated.

If it has been allowed to proceed until the bone has become involved and denuded of its periosteum, producing the typical sequestrum of osteomyelitis, it will be necessary to remove the dead bone before healing will take place. In these cases several weeks will be required. If it is opened before there is bone destruction and the actinic rays used daily, the case should be well in from one to two weeks. If it is far advanced, general supportive treatment will be needed in addition to the local treatment. However, all that is usually necessary is free drainage and actinic rays locally.

Case No. 269. Male, age 37. Was referred for treatment September 24, 1924, and gave a history of dactylitis of the left index finger of several months' standing.

On September 20, 1924, he noticed the same thing occurring in the right index finger. There was pain, redness, swelling with a softening area which I lanced. The left index finger was still discharging pus and it was necessary to remove several pieces of bone.

He was given two minutes of actinic rays with the water-cooled lamp at a distance of one inch. This treatment was continued daily for a few days but the progress was not as rapid as I thought it should be, so I added the general visible-light and actinic-ray treatments and gave him sodium iodide 32 grains and guaiacol $\frac{3}{4}$ of a grain intravenously, following which there was daily improvement. Fourteen treatments in all were given with com-

plete healing. There was some loss of function due to the removal of osseous tissue.

DIAGNOSIS: Osteomyelitis following Felon.

Fibroma Uteri.

Fibromata occur as submucous, intramural, subperitoneal, or pedunculated. They may be microscopic in size or they may weigh several pounds. They may be single or multiple. Rarely, indeed, are they accompanied by malignancy.

Their etiology is unknown.

Symptoms. The cardinal symptom is the finding of the tumor or tumors, although one closely allied to it is bleeding which may appear as a metrorrhagia or frequently as a menorrhagia prolonging the usual time of three days to a week or ten days. Delayed menopause is also a suggestive symptom of fibromata. This bleeding may be severe enough to exsanguinate or the prolonged repeated hemorrhages may produce a very severe secondary anemia. The large tumors give rise to various pressure symptoms, as constipation, irritable bladder, sciatica, and backache, particularly in the lumbar or sacral region. Should the tumor become lodged in the hollow of the sacrum, the pressure on the pelvic plexus will cause nausea and vomiting simulating pregnancy which dislodgement will relieve immediately.

Fibromata must be differentiated from other pelvic tumors as cysts, carcinoma or sarcoma, pyosalpinx, pelvic abscess, particularly when in the culdesac, and pregnancy.

The treatment may be either surgical as myomectomy, or supra-vaginal or panhysterectomy. X-ray or radium treatments may be given. Personally I prefer the radium as it is easier to apply and there is less likelihood of damage to the surrounding tissues. It must be remembered, and the patient must be informed in advance of the treatment, that it will cause an immediate artificial menopause which may be temporary as after a short intra-uterine treatment, or permanent if 50 milligrams are used for twenty-four or more hours. Radium or X-ray is the only physical-therapy treatment worth considering.

The results from their use are good as is the prognosis of all cases of fibromata.

Case No. A1. Female, age 42. February 16, 1925, we obtained the following history. She had been bleeding at irregular intervals for the past four years due to a uterine fibroma which was about five inches in diameter and located in the anterior wall of the fundus. She had been compelled to remain in the house for the past few weeks because of weakness and dyspnea on any exertion.

Her blood count at that time was as follows:

Hemoglobin	35%
Erythrocytes	2,200,000
Leucocytes	7800

Polymorphonuclears	78%
Small lymphocytes.....	14%
Large mononuclears.....	7%
Poikilocytes	Many
Myelocytes	1%

Because of the severe anemia only a small intra-uterine dose of radium was used, thirty-seven milligrams in one capsule for twelve hours with silver and rubber screening. The following day we began the general visible-light and actinic-ray treatments, ten minutes of the former and one minute of the latter. These were repeated daily, increasing the actinic-ray treatments one minute each subsequent treatment up to ten minutes.

Five days later the blood count gave:

Hemoglobin	45%
Erythrocytes	3,210,000
Leucocytes	7200
Polymorphonuclears	70%
Small lymphocytes	24%
Large mononuclears.....	3%

The next blood count was taken April 10, 1925.

Hemoglobin	50%
Erythrocytes	4,430,000
Leucocytes	6200
Polymorphonuclears	50%
Small lymphocytes	43%
Large mononuclears.....	3%

August, 1925, the blood count was:

Hemoglobin	60%
Erythrocytes	4,900,000
Leucocytes	7100
Polymorphonuclears	54%
Small lymphocytes	40%
Large mononuclears	2%

October, 1925, the blood count was:

Hemoglobin	75%
Erythrocytes	5,270,000
Leucocytes	7600
Polymorphonuclears	60%
Small lymphocytes	27%
Large mononuclears.....	8%

The last blood count taken March 4, 1926, was:

Hemoglobin	85%
Erythrocytes	5,290,000
Leucocytes	5100
Polymorphonuclears	58%
Small lymphocytes	37%
Large mononuclears	4%

DIAGNOSIS: Anemia (secondary to fibromata).

Fistula.

Rectal fistulae have for their etiological factors abscesses of ischiorectal fossae or the lodgment of fecal matter or other foreign bodies in the rectal pockets which produce a continued irritation and finally necrosis beneath the mucous membrane. The latter form of fistula will be found to have what is known as a sentinel pile which is a little tumor on the outside of the anus from which the fistula leads up into the bowel. The ischiorectal type will produce an internal blind fistula where the abscess ruptures into the bowel or an external blind fistula where it ruptures outward through the skin, or it may rupture both into the bowel and outward through the skin. These fistulae are known as complete. These complete fistulae are usually straight or nearly so, although many of them are exceedingly torturous taking in not only one but both ischiorectal fossae.

Formation of fistulae. Every abscess about the anus, bowel, or ischiorectal fossae, should be opened at the earliest possible moment and then treatment should be continued until every vestige of the tract has been obliterated, thus doing away with many of the present day fistulae.

The etiology of all fistulae is bacteria, principally staphylococcus.

The pathology is abscess formation.

The cardinal symptom of the fistula itself is a sero-pus discharge which is usually constant, although, at times, the external opening will close, which stops the discharge for a few days or weeks, only to break out again.

The usual symptoms accompanying this discharge are discomfort and at times pain, particularly when the external opening closes and the tract fills to the point of tension. A long train of nervous symptoms accompany fistulae and, many times, are not traced to their proper etiology but are treated as separate entities while allowing the fistulae to continue. Rectal and vesicle distress may accompany this condition and a mental distress always accompanies it.

While the diagnosis of this condition is usually the finding of the opening, either external or internal or both, it must be remembered that abscesses originating higher up in the pelvis or in the lumbar region may break through the tissues surrounding the anus. These, of course, will require their appropriate treatment.

Tuberculosis affecting the lower bowel or vagina may also produce cold abscesses and many small fistulae in this region and will require a separate treatment.

The general management of all fistulous cases is an excellent hygiene to produce the best possible physical condition of the individual. To this must be added a controlled exercise and a liberal

diet but of a type to produce a soft bowel movement. The bowels should be kept loose but not diarrheic.

The surgical treatment of a rectal fistula is to split the tract from one end to the other and, if possible, remove the wall of the fistula itself. This, many times, is impossible, but where the fistula is straight or nearly so it is easy to split it open and to place within the wound a pack of gauze, iodoform being a good drug with which to impregnate the gauze. This treatment is tedious, painful, and usually requires several weeks of after care and is not always successful.

Internally, drugs are of no use for the fistula but may help to build up the general condition of the individual. Drugs, subdermally or intravenously, are of no value. Locally, a 95 per cent solution of carbolic acid or, better still, argentum nitricum in a solution of from ten to twenty per cent and occasionally even a saturated solution injected into the fistulous tract and allowed to run out will produce a necrosis of the tract wall, thus allowing healthy granulations to take place, followed by adhesions which will close the tract. When using silver nitrate, the surrounding tissues must be protected by a sodium-chloride solution.

Physiotherapy offers a very decided aid in the treatment of these cases. Before using any drugs in the tract, it is best to give a number of treatments with actinic rays from the water-cooled lamp, not so much over the opening externally or internally as along the tract, which can usually be felt as a whip cord under the skin or under the mucous membrane. This area should be thoroughly reddened or even blistered one to three times weekly. Compression is not necessary. Many of these fistulae will heal after five to ten treatments. If after a course of ten treatments the fistula is still open or does not tend to close satisfactorily, it is well to use the argentum nitricum injection, remembering always to prevent the solution from entering the bowel in complete fistula and neutralizing the overflow with a saturated sodium-chloride solution. The same precaution should be taken externally by using cotton saturated with the sodium-chloride solution about the external opening during and after the injection of the silver salt. Following this, the actinic-ray treatments can be continued and these must be from the water-cooled lamp, for the distance is too great from the air-cooled burner to get the benefit of the short rays which are the ones most desired in this treatment. If the patient is asthenic or there is a secondary anemia accompanying the fistula, the patient should be given general treatments of visible light and actinic rays.

Again physiotherapy offers a decided aid to surgery. If these tracts are straight or nearly so, one should lay the tract open with a scalpel and then instead of trying to dissect out the tract, electrocoagulate it with the d'Arsonval current, using a needle electrode

with a milliamperage of about 500. This renders the cutting surgical operation unnecessary and replaces it with a bloodless method which removes the tract and reduces the after pains and renders unnecessary the packing of these wounds which is always a very distressing procedure for the patient.

Galvanism may also be used in the treatment of fistulae, using a bare copper electrode on the positive pole about the size of the tract and inserting it into the tract, using a current consumption of 10 to 30 milliamperes for ten to twenty minutes or until the electrode sticks to the wall. It is then removed by force, which brings with it a goodly portion of the tract, therefore do not reverse the current. In this way the copper is driven into the tissue forming the oxychloride of copper which is both antiseptic and destructive of the wall. While this is a tedious method, much more so than the actinic rays, it is many times very useful and where other methods cannot be carried out, is of decided benefit and should always be remembered.

The average length of time that it will be necessary to treat a fistula by physiotherapeutic methods is from two weeks to several months. Most of the simple ones are well in two to four weeks.

The complications accompanying fistulae are repeated recurrence, further abscess formation, retention of urine, and incontinence of feces due to cutting through the external and internal sphincters, particularly the former. Should this occur, a secondary operation will be necessary to reunite the cut ends of the sphincter muscle.

The prognosis in these cases is usually good, although recurrences are common. However, I am perfectly sure in my own mind that they develop less frequently after physiotherapeutic methods than after knife surgery, although at times the latter is a valuable adjunct in treating this condition.

X-ray and radium are of no practical value in this condition unless it is due to tuberculosis, and then they must be used with extreme caution, as the gamma rays and particularly the betas and alphas produce a violent proctitis with even a short treatment of one-half hour. If radium is used, it should be used beneath the mucous membrane and not against it regardless of the amount of screening used.

Case No. 77. Female, aged 42. Was referred for treatment October 25, 1923, for a recurrent blind, anal fistula. She had been operated one year before for this same fistula but it did not heal and had remained open ever since.

Her treatments were of one minute's duration. The first one closed the external opening and six other treatments six days apart were sufficient to completely heal the tract.

DIAGNOSIS: Anal Fistula, recurrent.

Folliculitis Barbae (Sycosis Vulgaris).

Folliculitis barbae is a non-parasitic sycosis. The disease attacks the hair follicles in any portion of the body but usually upon the face. It is a chronic inflammatory disorder which destroys the hair follicle and causes scar tissue to form about the site of the lesion.

Sycosis vulgaris has for its etiological organism staphylococcus aureus or albus. It is an infectious but not a contagious disorder and is transmitted from one person to another through the common use of razors, towels, brushes, combs, etc.

Its pathology is an inflammation of the tissues surrounding the hair follicle which is gradually transformed into small pustules thus producing scar tissue.

The cardinal symptom of this disease is the hair which protrudes through the papule or pustule, having at first the appearance of a vesicular eczema from which it must be differentiated. Usually there is some itching and the scratching of these vesicles transfers the disease to new areas. The disease must also be differentiated from other abscesses and from tinea barbae.

Its types are acute and chronic, although in the large majority of the cases the latter. In cases of long standing, where there is a great deal of scar tissue, the disease somewhat resembles lupus and must be differentiated from it.

The general management of these cases requires a careful hygiene. The surface must be kept free from pus and scab formation, due to the drying of the discharges, and anything that will improve the general health of the individual should be used.

In the treatment of this condition, surgery is used for drainage where the abscesses are large.

Drugs have but very little effect upon the disease and, if used at all, should be those which are bactericidal.

Actinic rays offer the best method of treatment. Local applications of actinic rays with the water-cooled lamp to the involved areas and surrounding tissues are usually all that will be required. The length of treatment should be from one to two minutes, at a distance of one-half inch, and should be given daily to weekly.

In treating diseases of this character, it must always be remembered that not only the apparent involvement is to be treated but the surface for some distance in all directions which may be involved, yet not to the extent to be observable macroscopically.

Complications are rare and are usually of the edematous type, due to irritation as much from various treatments as from the disease.

The average length of time a case of sycosis vulgaris will require treatment will be from a few weeks to months, as recurrences are common.

The prognosis, however, is good with the exception that where there is scar-tissue formation it will remain after the disease disappears.

Furunculosis.

Furunculosis is a staphylococcic infection usually starting in a hair follicle and producing a definite cellulitis with destruction of tissue which may be much or little, depending upon the depth at which the infection starts.

The necrotic area is usually thrown out en masse and is known as a core. While they usually occur singly, two or more may start so close together as to involve the same area of tissue. The infected areas are acute, although, through the development of new areas, the disease may extend over months of time.

The cardinal symptom is that of an acute inflammatory reaction starting as a papule followed by pustulation and fluctuation which, if allowed to go on undisturbed, will usually break through the skin of its own accord.

This disease must be differentiated from the folliculitis barbae which is also a staphylococcic infection but which does not involve the deeper tissues and which is less painful and produces more scar tissue, although both diseases start about the hair follicle. In folliculitis, there is usually a hair protruding through the infected area, while with furunculosis the hair disappears.

Furunculosis may occur upon any portion of the body, but it is usually found about the face, neck, particularly the back of the neck, in the axilla, and in the groin.

Bacteriology. *Staphylococcus pyogenes aureus.* The disease is superficial, auto-inoculable, and spreads along the hair shaft to the sebaceous glands, which carry it into the deeper tissues.

The general management of these cases requires a good hygiene, outdoor exercise, plenty of sleep, and a vegetable and fruit diet to produce the best general health, thus building up the resistance. Simple lancing for drainage is the immediate surgical treatment of these cases. Drugs are recommended internally for this condition but few of them have any definite value. Occasionally iodine locally is of value in the treatment of these cases; so is sulphur internally in doses of 1/100 of a grain or smaller. Sodium iodide, 32 grains, and guaiacol, $\frac{3}{4}$ of a grain given intravenously, are of use.

Local application of magnesium sulphate, an ounce to a pint of water, used as a wet dressing, gives relief after drainage. A wet dressing of a saturated solution of aluminum acetate or a twenty per cent solution of oleum terebinthinae in oleum olivae may be used to flood the cavity, but the treatment giving the best results in these cases is the mere lancing for drainage and the use of the water-cooled actinic-ray lamp for one to two minutes over the boil

and the surrounding tissues. Usually this gives immediate relief, although at times it is necessary to use an autogenous vaccine to prevent recurrences.

Complications are rare, although at times where there is a multiplicity of furuncles the system becomes badly depleted and in this condition it is necessary to give the general visible-light and actinic-ray treatments for their systemic effect.

The average length of time that these cases require treatment will be from one to three days for a small boil, while for the recurring crop of boils, many weeks or even months may be needed.

The prognosis is always good unless there are metastatic complications such as arthritis, thrombosis, or endocarditis, etc., which, of course, makes the prognosis grave.

Carbolic acid has been injected into the center of each boil, using a hypodermic syringe and injecting about one or two drops of a ninety-five per cent solution. When other treatment is not available, this is at least beneficial.

Irrigation of these cavities or the application of peroxide of hydrogen is wholly unnecessary. Powders should not be used, as they tend to form scabs, thus protecting the activities of the bacteria.

Ganglions.

Ganglions are small round tumors usually found on the back of the hand.

They are connective-tissue tumors developing in the synovial structure about tendons and joints and undergo central colloid degeneration which frequently communicate with the synovial cavity.

Excision under local anesthesia is the most satisfactory treatment, although opening and packing, while less classic, is frequently sufficient to cause adhesion of the cyst walls.

Gangrene.

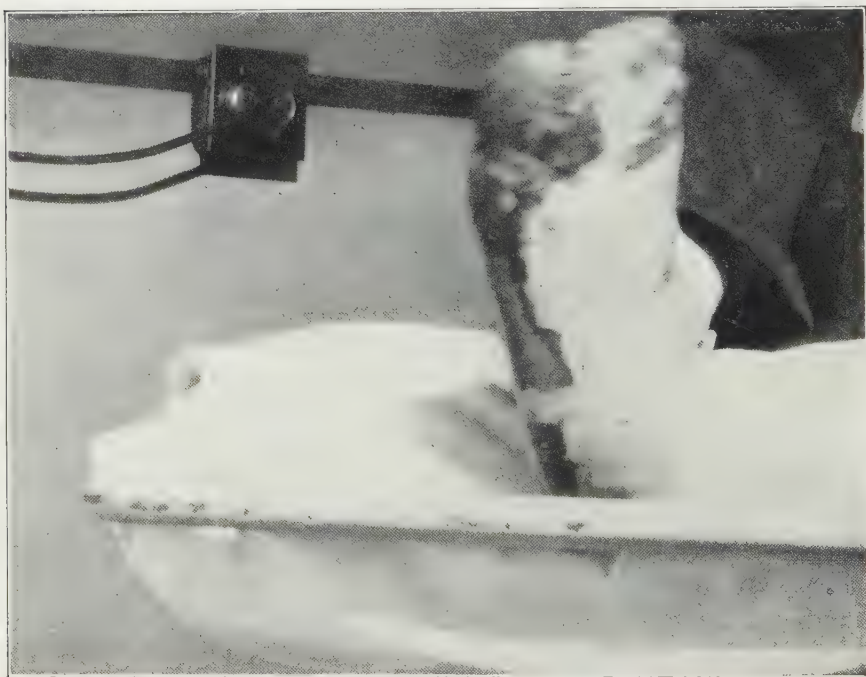
Gangrene is usually of two distinct types, moist and dry. The majority of the moist cases occurs in advanced cases of diabetes, while the dry cases are senile or arteriosclerotic. Anything that will destroy a terminal artery will produce gangrene whether it is thermal, chemical, or mechanical trauma.

The pathology is entirely due to the obstructed circulation, followed by the death of the tissue which does not receive nourishment from the blood stream.

The cardinal symptoms are first the local syncope, followed by redness which in turn is followed by gangrene or death of the tissue which at this time is a dark purple. This may start in a very small area and be confined there, but in most cases it spreads gradually hour by hour or at least day by day until areas are reached which are properly nourished. This is called the line of demarcation.



Senile gangrene due to arteriosclerosis.



Same case as above showing extent of gangrene.

The arteriosclerotic cases present no blood picture, while the diabetic cases will present a marked increase in blood sugar (average 300 to 500%).

The disease must be differentiated from other ailments which produce a partial obstruction to the circulation, thereby producing a reddening or slight purpling of one or more regions of various sizes. Principal among these is the vascular changes found in cases with varicose veins. Embolism or thrombus may produce a limited area of gangrene in any portion of the body, the lungs and liver being particularly liable to embolism, followed by gangrene of the area involved.

The general management of these cases will depend upon the etiological factor producing the gangrene, but almost invariably these cases require rest in bed, and a stimulating diet.

The treatment may be surgical after the line of demarcation has become fixed but not before. This applies particularly to the senile and pulmonary gangrene. Little can be done for the pulmonary gangrene unless abscess formation occurs, when it should be drained. For the diabetic gangrene insulin hypodermically is invaluable. For infective processes sodium iodide, 32 grains, and guaiacol, $\frac{3}{4}$ of a grain intravenously, will be of use.

Locally, drugs are of little value for the gangrene, but are of benefit to any accompanying infective process.

Heat in any form is beneficial but visible light is probably the best single method we have for affecting the circulation. This should be supplemented by actinic rays, particularly if there is an infective process accompanying. However, both must be used with caution, for any blistering of the surface or overheating of anesthetized tissue is liable to produce further destruction. Our usual method is to use visible light almost continuously until the circulation is re-established. Place the lamp (1000 watt bulb) about six feet away from the involved tissue, lessening the time and distance daily as the circulation improves. Actinic-ray treatments are given once daily for about one minute at a distance of twenty-four inches and the time cautiously increased.

The average length of time these cases require treatment will naturally vary a great deal. For the arteriosclerotic cases from a few weeks to months will be necessary for recovery, while for the diabetic gangrene the prognosis is usually fatal.

Senile Gangrene of a Foot.

Case No. 23B, Nov. 2, 1920. Male, age 63. When we first saw this case all the toes on the right foot had been gangrenous for six weeks and had become swollen and painful two weeks before this time. The gangrene extended back over the metatarsal bones and no attempt had been made to remove them. The odor was very intense and he had refused all solicitation to have the foot amputated. The general condition had been fair, although he had

a general arteriosclerosis. No definite promises were made to the patient as to what relief he could expect, but he was sent to the hospital in an ambulance for treatment with physiotherapeutic methods.

The first thing we did was to place a 1000-watt lamp over the foot of the bed about six feet from the uncovered leg and foot and let it shine continuously on them. Within twenty-four hours we amputated the toes as far as we could without pain or bleeding and without an anesthetic, allowing the planter and dorsal surfaces to separate as much as possible to allow the light to enter the gangrenous area. The improvement was almost immediate.

After the first day his condition was such that he could be moved and we started the actinic-ray treatments with the air-cooled lamp, giving a one minute treatment with the lamp at a distance of about twenty-four inches. After the third day we discontinued the continuous use of the visible light, giving him instead about two hours three times in twenty-four hours and continued the actinic-ray treatments, increasing one minute per day until treatments of ten minutes were given, after which they were maintained at this time.

After the first three weeks the visible-light treatments were cut to twenty minutes once daily and the actinic rays continued at ten minutes daily. At this time he was able to get out of bed and walk about on the heel and his general condition was steadily improving.

After six weeks' treatment the patient left the hospital and was able to come to the office for treatment, returning to the hospital at the end of the third month for removal of the metatarsal bones which were protruding through the wound, granulations having taken place all about them. From this time on the wound healed rapidly and he was discharged April 29, 1921, five months after starting the treatment with a good usable foot and a normal ankle. He was apparently in good health.

The accompanying pictures will give a good idea of the amount of the involvement of the gangrene which extended, as will be seen in the one picture, along the side of the foot nearly to the heel. This, however, only involved the skin and not the deeper tissues. Considering the length of time this case had run before any treatment was instituted it is really quite remarkable that his life was saved without amputation of the leg, which was the original advice offered in the case.

Ask yourself what the result would have been if the above treatment had been started as soon as the swelling and pain started.

Gastralgia.

Gastralgia is more a symptom than a disease. It is a frequent accompaniment of acute gastritis and gastric ulcers or hyperacidity and has for its usual etiology a free indulgence of either

food or drink which is too hot or too cold particularly the latter if the patient is over-heated. The attacks usually come on suddenly after eating indigestible foods. It must be remembered what is indigestible for one may not be for another. Occasionally a person is found who has an idiosyncrasy to foods which otherwise are digested with ease by the average individual. The pain may be accompanied by nausea and vomiting of sour, undigested, ill-smelling food which follows long retention, and if this occurs there is usually relief of the distress.

The cardinal symptom is pain referable to the epigastric region, but it may be general throughout the abdomen, and it must be remembered that pyloric spasms or esophageal spasms may give the symptom gastralgia. In hysterical persons flatulence may account for the symptom pain.

The condition must be differentiated from true gastric ulcers, acute dilatation of the stomach, gastric cancer, also from renal or biliary colic, intercostal neuralgia, or herpes zoster when it involves the lower dorsal nerves. The acute abdominal infections must also be differentiated from gastralgia.

Pancreatitis must also be remembered and an examination of the stool will show undigested fats and meat fibers.

The general management of these cases will be the immediate emptying of the stomach either by the use of lukewarm salt or mustard solutions or by simply drinking large quantities of hot water and then producing emesis. In rare cases it may be necessary to use apomorphin, one-tenth of a grain subcutaneously. After the stomach is emptied, rest is most important followed by the application of heat to the epigastrium. This may be in the form of a hot water bag, electric pads, or better still, visible light, and the patient should be put upon a fast lasting for a day or two after the pain has disappeared. It is best to empty the bowels by enemas rather than cathartics by mouth.

For true gastralgia, surgery is not indicated.

If drugs are used internally, they should be in very small doses. Drugs locally are of little value except as counter-irritants and of these mustard in the form of plaster is usually all that is necessary.

Physiotherapy offers but little for the immediate attack except for the use of the visible light which may be used continuously at a distance comfortable to the patient.

True gastralgia being a nervous phenomenon, complications are not to be expected. However, complicating diseases must be ruled out before making a diagnosis of simple gastric pain.

The length of time these cases will require treatment will depend upon the etiological factor causing the disturbance.

The prognosis is usually good but it will depend upon the underlying etiology. Before making a diagnosis of gastralgia, every other abdominal condition must be ruled out of the case.

Gastric and Duodenal Ulcer and Hyperchlorhydria.*

Benign, gastric and duodenal ulcers (syphilitic and malignant cases excluded from this paper) must be considered together, for in many instances it is impossible to differentiate them and for the additional reason that the treatment of both lesions is practically identical. This is equally true, whether we consider the proper treatment surgical, medical, dietetic, or physiotherapeutic. The treatment of the clinical dysfunction known as hyperchlorhydria should also be studied with gastric and duodenal cases, for its physiotherapeutic treatment is the same.

Etiology. The etiological factor of first importance in nearly all of these diseases is hyperacidity, although Rosenau holds focal infections a primal factor. They undoubtedly do play an important part. It is well known that focal infections gradually undermine one's physical well being, leaving the foundation for many diseases through lessened resistance. The third etiological factor is irrational eating, which may be detailed as improper food, improperly balanced meals, improper cooking, too much sodium chloride and, most of all, too little water. Trauma is rarely an etiological factor.

Symptoms. The principal symptom is pain, or at least discomfort, coming on as the stomach empties itself, allowing the walls to become apposed. There is at this time at the location of the ulcer in the stomach or duodenum a greater concentration of hydrochloric acid, hence renewed irritation. Pain starts from one-half hour to four hours after ingestion of food, depending upon the location of the ulcer and the character and quantity of food taken. This pain starts at the location of the ulcer and radiates upward and backward to a spot opposite the fifth dorsal vertebra, which spot many times is painful to pressure. In general, the closer the ulcer is to the cardiac end of the stomach, the shorter the time before the pain starts after ingestion of food, and per contra if the ulcer is in the duodenum.

The pain in these cases is nearly always relieved for a time by the taking of food, particularly fatty foods or oils, preferably olive oil or butter fats. Temporary relief of the pain or discomfort accompanying these cases may be had by the use of alkalies, which the writer feels should not be used in the treatment of these conditions, as it compels the system to secrete more acid, for the stomach contents are normally acid and cannot be kept alkaline for any great length of time and then only by the frequent taking of alkalies per orem.

During the painful period, as well as during the period of recession, there is increased sensitiveness to pressure over the ulcerated area, which is best elicited by pressure of the ball of the thumb on the tissues over the epigastric region. Nausea and vom-

*Read at the Thirty-fourth Annual meeting of The American Electrotherapeutic Association of New York City, September 9, 1924.

iting may or may not be present, but anorexia is always present, though in varying degrees. Most cases complain only of gastric distress, but discomfort or pain is invariably present.

The examination of the stomach contents will usually show an excess of total hydrochloric acid, varying in quantity up to 130 degrees, and a free hydrochloric acid above forty. If the ulceration is malignant, there will be a diminished or complete absence of free hydrochloric acid, while lactic acid and Boas-Oppler bacillus will now be present. While the absence of free hydrochloric acid is quite characteristic of malignancies, it must be remembered that it does occur at times with benign diseases and hydrochloric acid may be found with malignancies. Even occult blood in the stools is a very late symptom, coming only after destruction has taken place, while the vomiting of blood means deep ulceration. If the vomited blood is bright red, it means active bleeding and may occur from benign or malignant ulceration, while the coffee ground vomitus is characteristic of retained blood and is characteristic of advanced gastric carcinoma. Bleeding is always accompanied with severe secondary anemia with very rapid diminution of erythrocytes.

X-ray examination is of value during and after the hyperplastic or ulcerative stages, showing filling defects, but until far advanced these do not differentiate benign and malignant ulcers.

Diagnosis must still be based largely upon the clinical history of the case, assisted by the chemical and microscopical analysis of the gastric contents and the roentgenographic findings after a thorough examination of the entire alimentary tract. Examination of the feces will, in a limited degree, aid in clearing up the diagnosis of a doubtful case by the finding of occult blood.

There are many classifications of digestive ulcerations, most of which are useless when used as a guide to their successful treatment. The fractional method of chemical analysis brought out in 1914 by Rehfuss is having its day and is at times to be preferred to the single or Ewald method, for if there is a rapid increase in the amount of secretion during the first hour, the diagnosis of ulcer may be considered positive. The fractional method is valuable in showing, as it does, the varying degrees of acidity which occur during the digestion of a meal and to positively answer the question, "Is there an achlorhydria?"

The examination of the fasting stomach also aids in making a definite diagnosis, for with this method one can readily determine the stomach motility and the possibility of pyloric stenosis. Pyloric stenosis either organic or functional may be presumed, if the fasting stomach contains over 10 c.c. of gastric juices, and it may be as high as 60 c.c. The absence of free hydrochloric acid should always make one suspicious of malignancy. While the normal free acidity may be placed between 20 and 40 degrees, Boldyreff places

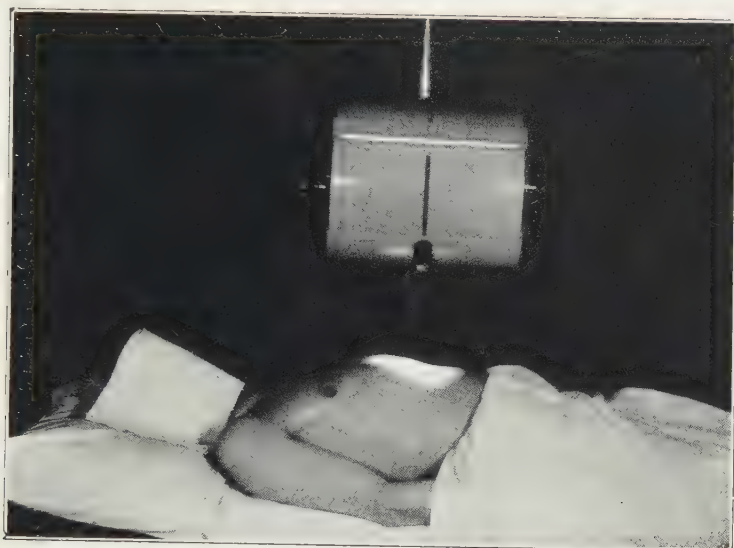
the normal secretion of free hydrochloric acid at about 0.4 per cent, while that obtained after dilution with the stomach contents, saliva and regurgitation of the alkaline duodenal contents, at about 0.2 per cent.

Present evidence points toward a greater percentage of cases with hyperchlorhydria in those suffering from duodenal ulcer than in those with gastric ulcer. Eggleston (Jour. Amer. Med. Assoc., July 26, 1924) thinks that hyperchlorhydria is much more suggestive of motor disturbance with a resulting hypersecretion than of any definite disturbance of the secretory mechanism. However, it seems fair to answer that this would cause a hyperretention, which might in turn cause prolonged stimulation of the secretory mechanism by distension, thus in turn producing hypersecretion. This same condition might occur as a result of a neurosis. Whatever the cause, I shall stick to my first statement that hyperacidity is one of the main factors accompanying gastric and duodenal ulceration; also that it is one of the main factors in producing the symptom complex we call duodenal ulcers, gastric ulcers, and hyperchlorhydria. Cases that simulate gastric ulcers or that may indeed be gastric ulcers are very possibly conditions with achlorhydria and are probably due to atrophic changes in the gastric mucosa. These cases are seldom benefited with actinic-ray treatments.

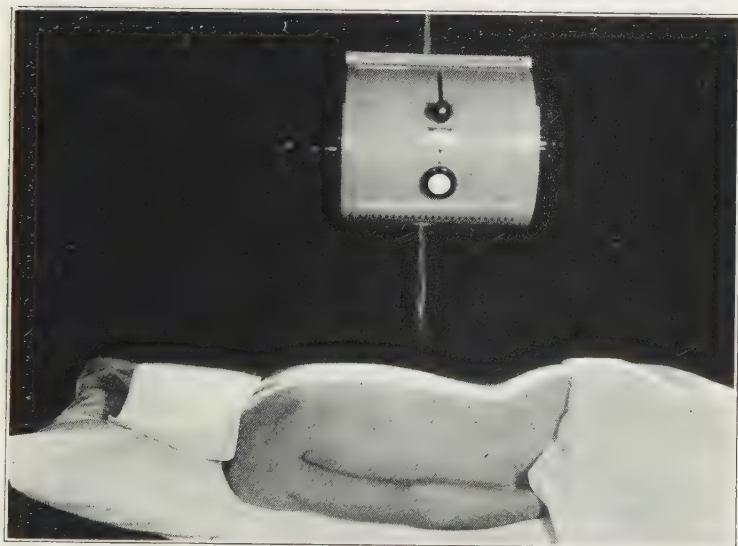
Differential diagnosis. Peptic ulcers must be differentiated from appendicitis, diseases of the gall bladder and ducts, the gastric crises of syphilis, chronic gastritis and carcinoma, also from extreme cases of flatulence.

Treatment. Diet. Water is to be given freely and often enough to keep the stomach washed clean. As a rule hot water is to be preferred to cool; never cold. All meats and meat broths or meat soups should be excluded from the diet, as should all condiments and foods containing acids. Sodium chloride should be excluded from all hyperacid cases, while both sodium chloride and dilute hydrochloric acid should be given to the hypoacid or achlorhydria cases. However, the hypoacid and especially the achlorhydria cases are very rare. The usual dose of dilute hydrochloric acid is from 10 to 30 drops well diluted, taken with meals. Sugar of all kinds should be prohibited. Start the case on milk and milk products, which should be continued for two or more weeks, after which vegetables and non-acid fruits, excepting citrus, are to be added. Meats should be excluded for at least two months and in some cases much longer. Alkalies are not used at all, and very seldom anything in the drug line. When necessary to neutralize the gastric acidity, we use olive oil or salt free butter fats.

Our principal treatment, however, is actinic rays. We start giving ten minutes of visible light over chest and abdomen, both front and back, following this with one minute of actinic rays from



Showing treatment for gastric or duodenal ulcers.



Showing method of treating spine.



Gastric and pyloric ulceration.



Appearance eighteen months later.

the air-cooled quartz mercury-vapor lamp, increasing the time of the actinic rays one minute each treatment until a maximum of ten minutes is reached, never going beyond this amount for the general treatment. The distance should be about 15 inches. However, we do give additional time over the epigastric region, usually about three minutes, with the lamp hood about 2 inches from the skin. Treatments are given daily for one or two weeks, then twice or thrice weekly for some time after all symptoms have disappeared, and the case is kept under observation for a year or more.

Case No. 214. Male, age 38. Draftsman. Came to us March 25, 1917, with a history of periodical attacks of pain in the upper abdomen lasting for a week or two, covering a period of some nine years. This attack had lasted since the first of January, 1917. Pain started about one and one-half hours after eating and was so severe that it required three to six quarts of milk a day and one quart at night to permit him to work and sleep. This was his method of stopping the pain when he came to us.

After one treatment of five minutes, he slept over twelve hours without awakening; no medicine was used. After two treatments with the actinic rays of five and six minutes, respectively, he was able to go one-half day without the milk and without pain. After eight treatments, the longest one of seven minutes' duration, he was eating regular meals and sleeping all night, and this without any pain. He had fourteen treatments in all between March 25 and May 7, 1917, when he felt so well that he stopped treatment without our consent.

October 5, 1917, he returned, saying that he had been having pain again for the past two weeks.

His actinic-ray treatments were as follows:

From March 25, 1917, to April 30th, they were given every second or third day. Following the return of the pain October 5th, they were given every other day during the balance of the month.

DIAGNOSIS: Gastric Ulcer.

Case No. 69. Female, age 27. Came to us March 16, 1923, with a history of having had gastric ulcers roentgenographically diagnosed for six years prior to this date. She had been vomiting practically all food taken for the past three months and had suffered constant pain.

Roentgenograms taken March 16, 1923, showed several filling defects along the greater curvature.

Her first treatment, given March 16, 1923, was ten minutes of visible light and one minute of actinic rays with the air-cooled lamp with a two-minute intensification over the epigastric region. Four hours later the vomiting stopped. Twenty-four hours later the pain disappeared as well as all nausea. At this time she was given ten minutes of visible light and two minutes of actinic rays and two minutes of extra raying over the epigastric region. These

treatments were continued, gradually increasing the time of the actinic-ray treatments up to seven minutes and the extra treatment up to five minutes. Neither pain, nausea nor vomiting returned after the second treatment. She was given a milk diet for the first three weeks, gradually adding vegetables after this period and was on a full diet except for meat after the second month. She discontinued treatments after the third month.

On September 12, 1924, eighteen months after taking her first treatment I had her X-rayed to check up on the condition of the stomach, although there had been no disturbance of any kind during the interval. The pictures opposite give her condition when she started treatment and eighteen months later. Plate XLVIII.

DIAGNOSIS: Gastric Ulcer.

Goiter.

Goiter may be defined as an enlargement of the thyroid gland. This enlargement may be accompanied by hypothyroidism or hyperthyroidism. The vast majority of the cases, probably ninety per cent, are of the hypothyroid type.

In the hypothyroid types there is a distinct decrease in the normal amount of iodine supplied the gland from the food intake. In other words, the gland is under-active and the enlargement is probably the effort of nature to increase the output of the hormone secretion and its iodine component.

The exact etiology, however, is in doubt, some holding that an increase in the calcium content of the drinking water is an important factor; others that various toxic substances are responsible for the growth. However, it is well known that certain districts have more goiter cases than others. Up to the present time no pathogenic organism or toxin has been found that would account for all cases. The etiology is probably to be found in the general metabolism, infections, neuroses, through general nutrition and its iodine content.

The function of the thyroid gland is not fully known, but it is known that it has a very definite influence upon metabolism and takes a part in the development of immunity from various infections. It also influences other ductless glands, particularly the ovaries. Too much secretion of the gland will produce a metrorrhagia or menorrhagia, while too little secretion will produce an amenorrhea.

While acute inflammation of the thyroid gland is well known, the vast majority of the cases are of the chronic inflammatory type. Acute cases of inflammation of the thyroid gland usually accompany some infectious disease. It is, therefore, probably an effort on the part of the gland to develop a greater immunity. This inflammation may go on to suppuration, although this is rare.

The symptoms of acute goiter are the symptoms of acute infection anywhere in the body, therefore, they need not be repeated here.

Chronic goiters constitute the vast majority of cases seen. The large majority of the chronic goiters are hypothyroid in type. Several varieties of chronic goiter exist, the most common being the adenomatous goiter or simple enlargement of the gland tissues. The next most common is the colloid, which in time may become cystic; the next, the fibrous type and then the calcareous type. It must not be forgotten that the thyroid gland may become malignant. It must be remembered that thyroid tissue may be found in the tongue and that an adenomatous thyroid may develop in this location. These cases, however, are exceedingly rare.

The cardinal symptoms of the hypothyroid type are those of simple enlargement of some portion of the thyroid gland. This may be either lobe or the isthmus or all combined.

The diagnostic point of non-toxic hypothyroid enlargement is the rise and fall of the mass when the patient swallows. If it is a simple hypertrophy of the gland tissue, the enlargement will be of normal texture, while if it is colloid, certain areas will have more or less of a doughy feeling. In the cystic cases, it will be possible to find areas which will fluctuate, while the fibrous type will give the sensation of hard fibrous tissue throughout the enlargement.

In these cases, the first symptom noticed by the patient is usually that of discomfort, especially when there is anything tight about the neck, when hurrying, or when excited. As the gland enlarges, dyspnea and aphonia will be prominent symptoms. These are due to pressure upon the trachea and recurrent laryngeal nerve. There is no definite blood picture with this disease.

Hypothyroidism must be differentiated from hyperthyroidism or the toxic type, which has as its characteristic symptoms tachycardia, tremor, general nervousness, and exophthalmia. As the toxemia becomes extreme, there are symptoms of disturbed digestion accompanied by nausea and vomiting and a general loss of flesh, usually some tanning of the skin, not to the extent, however, that is found in Addison's disease. Simple goiter must be differentiated from malignant or benign neoplasm, as carcinoma, sarcoma, tubercular adenitis, Hodgkin's disease and exophthalmic goiter.

The management of the chronic hypothyroid type of goiter will consist of a moderate amount of exercise and a diet as rich in iodine as it is possible to obtain.

In the treatment of these cases, surgery must always be considered and is the only treatment worth while for colloid, cystic, calcareous, or fibrous goiters. However not everyone of these cases

require surgery, as many of the goiters are small and produce no symptoms beyond the disfigurement, therefore are not necessarily surgical except for cosmetic reasons.

Drugs are useful in the hypothyroid type, iodine being one of the principal ones. This may be used internally or intravenously. For young girls and especially in those with an inadequate menstruation, iodine may be used internally in the form of sodium iodide, one to two grains daily, or of iodide of lime, one-fourth grain twice a day. If time is a factor, the use of sodium iodide intravenously in ten-grain doses will have a distinct advantage over the internal administration. Locally, drugs are of little if any benefit.

In the hypothyroid types of goiter, physical therapy offers much. Vibration is the main reliance and is used over the gland itself for a period of five to ten minutes followed by either vibration or concussion of the second and third dorsal vertebrae for a period of two or three minutes. These treatments should be given three times a week until there is definite improvement, then twice a week.

The average length of time these cases will require treatment will be from three or four treatments in young girls up to ten or twenty treatments for those under twenty years of age. If the age is between twenty and thirty, double the number of treatments may be required, while if the age of the patient is between thirty and forty, much less can be accomplished. After forty years of age, comparatively little is accomplished by this method of treatment.

If there is an accompanying infection of the tonsils, actinic rays from the water-cooled lamp over the tonsillar areas, pillars, and pharynx are of distinct advantage. These treatments should be of one minute's duration. Actinic rays may be used with benefit over the thyroid gland, but women seldom wish to have their necks blistered and it is necessary to produce a distinct hyperemia if benefit is to be derived from this method of treatment.

Complications are rare, fortunately, and are usually from pressure symptoms which is particularly true if the goiter is growing downward into the thorax rather than upward above the clavicle. In these cases dyspnea and cyanosis may be sufficient to cause extreme anxiety. There is congestive enlargement of the gland during the menstrual period, and a rapid, more or less permanent enlargement during pregnancy.

The prognosis of this type of goiter is good, although it may be impossible to reduce the gland to normal size.

Malignant goiters may be either primary carcinomas or sarcomas. Carcinomas usually start from a diffused adenoma. These differentiate themselves from the ordinary goiter in the rapidity of their growth and the involvement of the lymph glands which

drain the thyroid. This symptom alone would be sufficient to differentiate it from the chronic goiter of the hypothyroid type, which does not involve the lymph glands.

While radium and X-ray offer comparatively little for the reduction of the ordinary non-toxic chronic goiter, they offer much for the malignant goiter. Exophthalmic or toxic goiter (synonymous with Graves' or Basedow's disease) may or may not be accompanied by enlargement of the thyroid gland, but if enlarged it is usually very much smaller than the chronic hypothyroid type.

Exophthalmic goiter is always accompanied by hyperthyroidism.

Its etiology is apparently similar to that of a non-toxic type, with this exception, that toxic substances tend to aggravate it, as do various nervous phenomena. Whether the nervous phenomena act directly upon the thyroid secretion, or whether it acts primarily through the adrenals has not yet been proved.

In pathology this type of goiter is always parenchymatous.

The cardinal symptoms of this disease are nervousness, which is usually general, muscular tremor, particularly of the hands, tachycardia, and later the prominence of the eyeballs, from which it derives its name. As the toxic symptoms increase, the digestive disturbances become pronounced and there is nausea and vomiting and wasting of the tissues of the body. On the other hand, the hypothyroid case is always obese.

The greater the toxic symptoms, the greater the atrophy of tissue. These patients are highly excitable and if the toxicity is extreme, insanity may develop.

After the eyes become prominent, there is an inability to close and a slowing up of the ability to raise the upper lid.

In the simple toxic case, the pulse rate will be from 125 to 150.

Basal metabolism will help in diagnosing those cases which are not well defined. The basal metabolism rate will run from 60 or 70 up to 120 plus or more. Given a high strung individual with a fine tremor, exophthalmic goiter should be suspected, although it would be in a very early stage. The vast majority of the cases occur in women, although men, children, and even infants may be affected.

Toxic goiter leads to an excessive activity of the thyroid glands. There may be a perverted function, but this is not proved. An enlarged persistent thymus has been found in numerous cases to be associated with toxic goiter.

The blood picture in this disease is not accurate but the number of red blood corpuscles remain about normal, while the polymorphonuclear leucocytes are reduced.

These patients may all be called neurotic; therefore all neurotics must be carefully examined for symptoms of hypersecretion or dysfunction of the thyroid gland. The exophthalmic case must be differentiated from simple neurasthenia, chronic interstitial ne-

phritis, aortic regurgitation, and exophthalmos due to local conditions as sarcomas, etc.

The general management of these cases requires a strict hygiene, a limited exercise, and when the disease is advanced and there is a distinct atrophy of the muscular tissues, rest in bed is imperative. The diet in these conditions should be light and as much as possible to the patient's liking, particularly if there is nausea and vomiting. In addition to the rest in bed, which must be absolute, both mental and physical, the use of cold over the heart will help to make the patient more comfortable, although it does not cure the disease. In the extreme cases, surgery is dangerous and the most that should be undertaken is a simple tying of the superior thyroid artery in an effort to limit the blood supply to the gland, thus in turn limiting its secretion.

Drugs are useful for this condition. They are used for the same purpose as surgery—to limit the blood supply to the organ. Ergotoid may be given in doses of one grain or ergot in doses of thirty drops, while quinine hydrobromide may be given in doses up to five grains three times a day.

Iodin should not be used in these cases, neither should thyroid extract. Both are extremely useful for the hypothyroid type.

Local treatments, except that of cold, are of little value. Cold limits the amount of blood supply to the organ, therefore, is a good palliative measure.

Physiotherapy aids to some extent, at least, in the early stages where the treatment is similar to that of the non-toxic goiter. Vibration over the gland itself for above five minutes and concussion or vibration between the sixth and seventh cervical vertebrae for two or three minutes is of value. This has the distinct effect of lessening the secretion materially, and if there is a metrorrhagia accompanying the condition, it will be materially relieved in a very short time, many times after the first treatment.

For the toxicity, general visible-light and actinic-ray treatments are of distinct value. In hyperthyroidism either X-ray or radium is of value. Radium is easier to apply as it is much more easily localized and can be carried to the patient. The treatment should be short, using about 100 milligrams of radium for one and one-half hours in packs with about 3 cm. of leather, 1 mm. of rubber, 2 mm. of lead, and $\frac{1}{2}$ mm. of brass as filters thus avoiding radium dermatitis. The treatment should be repeated at weekly or monthly intervals as indicated for two or three treatments, then discontinued for two or three months. These cases will require observation for months or years.

Diathermy may be used with a 3 x 4 electrode over the gland, and a 4 x 5 electrode over the posterior cervical region. Start with all the current the patient can tolerate, then decrease it one-third. The treatment should be from ten to thirty minutes in duration and given three times a week. In some cases, this gives a decided relief.

Hyman and Kessel in a study of fifty unselected cases of exophthalmic goiter treated with "skilful neglect" found that a spontaneous course toward economic restitution occurred in 83% of the cases. In considering any form of therapy in these cases, this must be kept in mind.

The prognosis is good provided there can be a limiting of the blood supply to the gland, otherwise it is very grave.

Case 82. Male, age 47. Came to us February 1, 1923, with an enlargement of the right lobe of the thyroid gland which gave fluctuation on palpation. It was about 5 cm. in diameter. There was no pain connected with the growth and the patient stated that it had grown rapidly the past two months.

His treatment was radium applied in two needles of 12½ milligrams each, inserted into the cyst cavity, and two 25 milligram packs placed on the surface, all of which were allowed to remain for twelve hours. The cyst was then aspirated, about one ounce of serum being removed. Three days later the cyst had not refilled and the mass itself seemed smaller. Three weeks later the mass had almost entirely disappeared, and up to September 10, 1925, there had been no recurrence.

DIAGNOSIS: Goiter, cystic.

Case No. 58B. Female, age 60. Was sent to me for treatment of an enlarged thyroid gland. Examination showed enlargement of the left lobe and isthmus. There was tachycardia, tremor, and exophthalmos.

Her only treatment was three packs of radium of 50 mg. each, applied for three hours over the enlargement.

In one week there was a reduction in size of the lobe and in one month the tremor and tachycardia had disappeared, and there was some diminution in the exophthalmus. Her general health was improved.

DIAGNOSIS: Goiter, exophthalmic.

Gonorrhea, Anterior and Posterior Urethritis and Gleet.

Gonorrhea is a specific inflammation of the mucous membrane occurring in about the following order: Urethra with Cowper's glands, vagina with Skene's and Bartholin glands, eyes with lachrymal glands, and rectum.

It is both acute and chronic. The acute is known as the anterior urethritis, while posterior urethritis is usually classed as chronic.

The inflammation of the mucous membrane is, at times, accompanied by small ulcers in the urethra, on the vaginal wall, on the cornea, or the rectal wall.

The cardinal symptom is a creamy-yellow discharge which, when examined under the microscope, contains the bacillus of Neisser. The acute cases will always show the bacillus while, at times, the chronic cases with a serous discharge will show other

bacteria in place of the Neisserian. Among the usual symptoms is the discharge, which will occur within three or five days after the infection, which is accompanied by smarting and which becomes painful, particularly during urination. The posterior urethritis is the extension upwards of the infection and usually occurs within ten days. Without treatment the symptoms usually begin to abate about the second or third week following the infection, provided there has not been extension into the prostate, seminal vesicles, vas deferens, or epididymis.

While the chronic urethritis is usually posterior, at times ulcers may continue in the anterior urethra for many months or even years and are the cause of the condition known as gleet.

The diagnosis of this condition should always be made with the microscope and this will clearly differentiate it from other diseases of the mucous membrane of the urethra, rectum, eyes, etc.

The general management of these cases requires a strict hygiene, a limited amount of exercise, as much rest as possible during the acute stage and a bland non-irritating diet.

For the urethritis itself, surgery is seldom indicated. For the sequelae, which are mainly strictures of the urethra and epididymitis, it may be necessary to use surgery.

Internal medication does little for these cases, but occasionally hydrastis canadensis, 1/100 of a grain, or gelsemium, 1/100 of a grain, are of value. Autogenous vaccines given subdermally are, at times, of value. Sodium iodide, 32 grains, and guaiacol, $\frac{3}{4}$ of a grain given intravenously, are invaluable, although not a specific. One of the silver salts or one of the dyes may be used locally. These do not clear up all the symptoms of the disease, although they do aid in lessening the discharge. Where there are ulcers in the urethra, a local application of a ten per cent silver nitrate solution is of value and applications must be made through a urethroscope directly to the ulcer and not to the surrounding tissue.

While the disease remains localized in the urethra, comparatively little can be done by physiotherapeutic methods, although actinic rays applied locally for one minute to the outside of the urethra daily or thrice weekly are of distinct value. Skene's glands as well as the Bartholin glands are very likely to be complicating factors and these are very satisfactorily treated by the use of the water-cooled actinic-ray lamp for one to three minutes daily at a distance of about one inch. If, however, abscesses have formed, excision or destruction by electrocoagulation will be required.

If the diseased area is limited to the vagina, it can be very satisfactorily treated with actinic rays from the water-cooled lamp for one to four minutes daily. After it has spread up into the uterus and through the tubes the actinic rays are not as efficient but can be used for the salpingitis and with a fairly satisfactory result. In these cases, it is best to give a general visible-light and

actinic-ray treatment as well as a local treatment with the water-cooled lamp, which should be given daily for one to four minutes. These local treatments should be given through a bivalve speculum, using a proctoscope to prevent blistering the vulva. They should be given daily until there is definite improvement, then three times a week. The first half of the treatment should be given with the bivalve in the usual position, the second half rotate the bivalve one-fourth, thus raying the anterior and posterior walls with the urethra and Skene's glands.

For gonorrheal ophthalmia or corneal ulcers, the dyes or silver solutions are efficient, although the actinic rays from the water-cooled lamp may be used, giving two or three flashes daily.

In the male, the usual complications are vesiculitis, prostatitis, cystitis, epididymitis or an orchitis. For these complications, visible light and actinic rays are invaluable. There is nothing that I know of that equals the actinic rays in the treatment of a chronic gonorrheal prostatitis. These treatments are given through the rectum, using a proctoscope and treating each of the three areas for two minutes, covering the seminal vesicles and bladder, upper half of the prostate, lower half of the prostate and membranous urethra. Following the raying of the prostate, it is well to ray the outer surfaces with the water-cooled lamp for two or three minutes, thus producing a hyperemia over the perineum, scrotum, and under-surface of the penis, as well as raying the inguinal glands, which are frequently infected and thus are a complication of gonorrheal urethritis.

As this disease is infectious, these patients must be instructed to use the utmost precaution not to carry the infection into the eyes or other mucous membranes. They must also be cautioned about infecting others by the common use of toilet articles, towels, etc.

The average length of time it will take to treat acute gonorrheal urethritis will be from three to six weeks; usually two to four months for the chronic cases.

The prognosis of these cases is good so far as life is concerned, but leaves more or less damaged structures behind which may produce both immediate disability and discomfort, and disability in after years. Principal among these is sterility in both sexes and hypertrophy of the prostate in the male. The fallopian tubes become distorted and strictured and this condition is a probable cause of extra-uterine pregnancy. Phimosis and paraphimosis will both complicate gonorrheal cases in the male.

Seminal vesiculitis usually occurs as a complicating factor at about the same time as epididymitis. Skene's glands in the female become infected early; so may Cowper's glands in the male. In both male and female, but particularly in the former, there is likely to be an extension upwards from the urethra into the bladder and up through the ureters into the pelvis of the kidney.

The female is not likely to develop a peritonitis from extension through the tubes unless there is a mixed infection, as the fibrinated extremity is usually inverted and sealed early. However, ovaritis may accompany a salpingitis.

Gonorrhea in infants and children is usually confined to the female sex and consists of vulvitis and vaginitis, although at times the urethra with Skene's glands become involved. As a rule, there is comparatively little pain in children. When the urethra is involved, Skene's glands are likely to be, but the Bartholin glands are not, for the reason that at this time they are undeveloped, and for the same reason the uterus and tubes are not infected.

Because of our inability to reach all areas adequately, these cases are liable to persist for months and even years.

The diagnosis is made by finding the Neisserian bacilli. Every caution should be made in these cases to keep the infection from the eyes. For the vulva and Skene's glands, actinic rays is one of our best methods of treatment. The water-cooled lamp is used and treatment should be given for about one minute for the vagina and urethra, followed by the injection of one of the silver salts or one of the dyes into the urethra and vagina by using a small silver tip about four inches long on a 2 cc. Luer syringe. Sometimes one preparation will work better than the other and it may be necessary to try several of them before an effective method of treatment will be found for the individual case. Systemic treatment is not required for these cases.

Gonorrheal Arthritis.

Gonorrheal arthritis will be considered separately, although it is a direct complication of a gonorrheal urethritis. It does not spread by continuity or the lymph stream, but through the blood stream. While it may attack any or all joints, it is usually confined to one in about the following order: first knees, then ankles, hands, elbows, shoulders, while the hip joints are least likely to be involved.

The one cardinal symptom of this disease is the fact that it usually occurs in one joint. If in several joints at the same time, it is probably polyarthritis and due to other infections and is thus differentiated.

These cases require the same general management as the local disease, but in addition to the treatment for the local disease these cases require rest in bed with as little handling of the joint as possible. Surgery is indicated if the inflammation goes on to suppuration.

Internal medication will avail but little. Autogenous toxins will help in some cases. Intravenous medication of sodium iodide, 32 grains, and guaiacol, $\frac{3}{4}$ of a grain, is of decided benefit. Local medication is limited to wet compresses, the value of which may

be materially increased by the use of an electric heater to maintain a high temperature.

Physiotherapy offers the best method of handling these cases and of this diathermy exceeds all others. These treatments should be given through the joint both anteroposteriorly, and laterally. The technique is to use a pad of sufficient size to cover the entire inflamed area from top to bottom, leaving a space between the applicators about equal to their width. The d'Arsonval current is used to the point of tolerance to the patient. This will be from 50 to 100 milliamperes per square inch of the smaller applicator used. This treatment should give relief in about thirty minutes.

These treatments must be given daily until the pain has subsided, then thrice weekly until motion is fully restored, which should be the final outcome if the case is seen at all early.

If infection and suppuration have taken place with their accompanying destruction of joint surfaces, it will of course mean more or less permanent disability.

General visible-light and actinic-ray treatments will be of benefit in these cases and a very mild actinic-ray treatment with the water-cooled lamp over the joints, sufficient to produce a slight hyperemia, will also have a definite value. These cases will require treatment for from three weeks to three months.

Gonorrhea in males may be treated by diathermy. The external genitals are placed in a basin of water into which one electrode is immersed. The second electrode is placed over the lumbar region. The current is gradually increased to tolerance and kept there for thirty to forty-five minutes. These treatments should be given daily.

If seen early, the prognosis is always good. After joint destruction has taken place, the prognosis is good as to life, but not good as to function.

Gout.

Gout may well be termed a localized arthritis due to faulty digestion. Sometimes it is both acute and chronic; acute in regard to attack, chronic in time of recurrence.

Its etiology is a faulty metabolism probably due to improperly destroyed purine bodies. The deposit of urates or calcium about the joints, particularly of the great toe, is its most characteristic manifestation.

Its cardinal symptom is the rapidity of its onset which is usually nocturnal and without any warning, although premonitory signs are at times experienced. These usually refer to digestive and circulatory conditions which are aggravated as the arthritis develops.

These cases must be differentiated from other arthritides and from general constitutional diseases which they may complicate.

The general management of the case will require a strict hygiene, a limited exercise, and during the period of the attack, rest in bed. The diet will require the utmost attention while the bowels should be kept free but not loose. Many of these cases will do best if fasted for a time when starting the treatment. Water, both internally and externally, is of the greatest advantage. The patient should be required to drink large quantities of pure water containing little mineral element. On the other hand, baths of all sorts, especially mud baths or those taken in an electric light bath cabinet, are of decided benefit.

Surgery is used only when the joint becomes so large that it interferes with locomotion.

Of drugs, colchicin is undoubtedly the best and should be given in doses of 1/134 of a grain several times a day until the bowels become loose, then less frequently. This drug can now be given intravenously in doses of 1/100 of a grain with sodium salicylate and iodide, 15½ grains each.

Locally, drugs have but little effect on these cases, although packs saturated in magnesium sulphate, one ounce to a pint of water, give at least temporary relief.

Physiotherapy offers much for these cases. It includes electric light baths, general visible-light and actinic-ray treatments, with actinic rays from the water-cooled lamp applied locally over the joint. Diaphoresis is quickly established by placing the patient in an electric bath cabinet and with it an immediate elimination of toxins.

The d'Arsonval current, using 200 to 400 milliamperes, for thirty minutes daily, is at times beneficial and is best applied by immersing the toe in a basin of water which is connected with one pole, the other pole attached to a metal cuff just below the knee, or what is better, an applicator of composition metal over the calf of the leg. This heats not only the toe but the entire foot as well.

The average length of time these cases will require treatment is usually a few days for the acute exacerbation, although once established these cases seldom get entirely well, so acute exacerbations are to be expected throughout the life of the individual.

The prognosis for the individual attack is probably good, but the outcome must eventually be bad.

Granulating Tissue.

In treating granulating tissue, during the repair process, the use of actinic rays should be carefully supervised, for it is possible to destroy this tissue with the rays from the water-cooled lamp; therefore, no treatment should ever be over two minutes and from one-half to one minute is sufficient to sterilize the surface of the wound and this amount aids materially in the healing process.

Hay Fever.

Typical hay fever is a coryza of protein etiology. It starts at a definite time each year and continues from four to eight weeks, usually stopping only with the appearance of frost or a change of climate to one which has an absence of the pollen or irritant causing the disturbance. Other forms of coryza, many times, simulating hay fever, occur from inhalation of various substances or odors which may come from plants, animals, dust, etc.

It is both acute and chronic. Acute because it is of comparatively short duration and chronic because it recurs at regular annual intervals.

The etiology is any substance which will excite the hypersecretion and turgescence of the nasal mucosa.

The pathology is usually that of simple, intense congestion of the mucous membrane of the nasal cavities and the accessory sinuses.

The cardinal symptom is the coryza recurring at a definite period. The usual symptoms are the watery nasal secretion and the inability to breathe through the nostrils. With this intensity, there is usually a temporary stoppage of the nasal ducts which pours the strongly alkaline tears over the cheeks, causing irritation of the lower lids. The irritation produced by the mucous membrane of the turbinates coming in contact with that covering the septum produces constant and violent sneezing. In some cases there is an actual or a sympathetic asthma manifested by a definite dyspnea.

In diagnosis it must be differentiated from other catarrhal infections of the upper respiratory tract.

The general management of these cases gives little relief of the symptoms. Surgery is indicated if there are polypi or nasal obstructions from any cause. Of drugs, many are recommended, but few are useful. Locally, adrenelin gives temporary relief and if the disease is accompanied by asthmatic symptoms subculoid lobelia given subcutaneously in doses of one or two cc. is of definite value for immediate relief. Lobeline, 1/200 of a grain, may be substituted for the subculoid lobelia and repeated in fifteen minutes if necessary.

Physiotherapy should, however, be the main reliance in the treatment of this condition. Use a non-vacuum nasal electrode, which is attached to the Oudin current of a high-frequency machine for about five minutes, in each nostril at a temperature comfortable to the patient. Follow this treatment by a one or two-minute application of actinic rays from the water-cooled lamp through a quartz rod introduced into each nostril. This will give immediate relief of the symptoms.

Treatment should be given daily for a few days, then thrice weekly. This will carry these patients through a season in com-

fort. While it is not curative, in the sense that the disturbance will not return the next year, at least it does more than any other known treatment at the present time and several successive years of this treatment seem to bring a certain amount of immunity.

These cases will require from two to four weeks treatment each year and it is best, if possible, to start the treatment a week or two before the expected attack.

The prognosis as to life is always good.

Case No. 314. Female, age 36. Has had hay fever for eight consecutive years. As she lives out of the city, she took her actinic-ray treatments two weeks previous to the expected attack. We used the water-cooled lamp with the solid-quartz applicator, treating the interior of the nose as follows:

DATE	ACTINIC RAYS		CLINICAL FINDINGS
	Water-cooled Lamp		
1917	Duration of Treatment	Distance from Patient	
Aug. 4	5 min.	Contact	Breathing more freely. Breathing more freely.
Aug. 5	4 min.	Contact	
Aug. 6	4 min.	Contact	
Aug. 7	5 min.	Contact	
Aug. 8	6 min.	Contact	
Aug. 9	7 min.	Contact	
Aug. 10	6 min.	Contact	
Aug. 29	.....	.....	
			Reported she was having the least hay fever she had had in years.

Case No. 484. Female, age 42. Hay fever in September, 1917. Sneezing constantly with lachrymation for several days past. Actinic-ray treatments with water-cooled lamp to interior of nose with solid-quartz applicator used in contact with the turbinates.

ACTINIC RAYS			CLINICAL FINDINGS
DATE	Water-cooled Lamp		
1918	Duration of Treatment	Distance from Patient	
July 8	3 min.	Contact	Improved. Sneezed once during twenty-four hours. Sneezed once during twenty-four hours. Much improved. No sneezing.
July 10	3 min.	Contact	
July 11	3 min.	Contact	
July 12	3 min.	Contact	
July 17	3 min.	Contact	
July 21	3 min.	Contact	

DIAGNOSIS: Hay Fever.

Hemorrhoids.

Hemorrhoids may be classed in two ways, either acute or chronic, or as internal or external.

As to *etiology*, hemorrhoids are due to obstruction of the return flow of blood. The obstruction may be due to a variety of

causes, as constipation, proctitis or colitis with diarrhea or dysentery, pelvic malignancies, straining at stool, fibroid tumor, a subinvolted, retroverted, or pregnant uteri, obstruction of the portal circulation, or anything that will press upon the veins and obstruct the return flow of blood. Whatever the cause or disease producing the obstruction, the hemorrhoids themselves are purely a local affair.

There is no bacteriology.

In pathology it is either a dilated vein or the rupture of a vein or capillary usually at the mucocutaneous border. Both conditions are accompanied by thrombosis.

The cardinal symptom of hemorrhoids is the pile or protuberance. The usual symptoms are pain, protrusion of the pile mass when the bowels move, and at times bleeding from a rupture of the capillaries in the mucous membrane. There may be but a few drops of blood or a vessel may rupture, thus causing a serious hemorrhage.

The diagnosis of the condition is usually very easy, while the etiological factor producing it may be very difficult to diagnose. If possible, the underlying etiology should be ascertained, as 95% of the cases of cancer of the rectum are diagnosed and treated as hemorrhoids for weeks to months before the real etiological factor is known. It is next to useless to treat hemorrhoids until the etiological factor has been removed.

In diagnosing this condition there are three general types which will be found: the strawberry type, which is a capillary hemorrhoid and is usually small, not much larger than a filbert; the second is the thrombotic type which is a blood clot within the tissues or within the vein; the third type is the cutaneous tab which is the result of a former thrombotic hemorrhoid.

The general management of these cases will consist of good hygienic living and at least one daily bowel movement without straining or drastic cathartics. Exercise to maintain the general body health will be of value and rest in bed will be necessary in the more severe cases where the pain is intense.

In the surgical treatment of these conditions, the capillary type and the cutaneous tab type may both be cut off by catching the tip of the hemorrhoid in a toothed forcep and making slight traction using a curved scissor to amputate the pedicle, after which one or more stitches may be placed to coapt the cut edges. This should be done under local anesthesia and the case need not be hospitalized. Where there is a large protrusion, particularly of the internal type, it may be necessary to use a clamp, which is better if curved. Draw the hemorrhoid down with a T forceps, apply the clamp to the base; watch the breathing; if it continues good, the pile may be cut off with cautery, scissors, or scalpel, just above the clamp. A No. 1 catgut suture is then tied just above the

tip of the clamp and a running suture placed around the clamp and left loose. When the last stitch is in place, the clamp is cautiously loosened and slipped out of the suture, which is then drawn taut and tied. This holds the cut edges together and prevents either primary or secondary hemorrhage.

A still better method, if one has a high-frequency machine at hand, is to use a hot spark from the d'Arsonval current to coagulate the tissue thoroughly before it is removed by cutting. This will absolutely seal the edges. This, however, should not prevent the use of the over and over stitch to hold these edges from separating when the slough loosens. Local anesthesia is sufficient for these cases.

Drugs internally have but little or no effect upon the removal of hemorrhoidal tissue, although drastic cathartics are an etiological factor. Carbolic acid in a five to twenty per cent solution in glycerin or Wesson oil is, at times, used with benefit by injecting two or three drops at the apex of the pile, thus destroying the blood supply. This method may be used when other means are not at hand. Intravenously, drugs are not of benefit in this condition. Drugs applied locally are seldom curative, although at times an opiate used in this way is a good palliative.

Treatment from a physiotherapeutic point of view is very successful in these cases. For the acute capillary type or the acute thrombotic type, a treatment of one-half to one minute with the water-cooled quartz-mercury lamp under pressure with a quartz applicator is usually sufficient to stop the pain within a few hours and from one to six treatments are sufficient to restore the condition to normal.

If actinic rays are not at hand, a cone-shaped dilator used on a vibrator running from 1500 to 2000 revolutions per minute, the vibratode inserted gradually into the bowel and vibration continued for one or two minutes is of decided benefit and, many times, all that is necessary.

In the treatment of any case, the gradual dilatation of the sphincter relieves a great deal of tension. At times electrocoagulation, using the d'Arsonval current, is useful in this condition, but must be used in one of two ways, either by inserting a needle into the base of the hemorrhoid, using a small quantity of current—about 300 milliamperes (one or two seconds)—just enough to destroy the blood vessel at the base, thus allowing the hemorrhoid to contract without ulceration, or use enough current to actually destroy the hemorrhoid, allowing it to slough off. Do not destroy the tissues below the mucous membrane. The latter method means an open ulcer which, if in the grasp of the sphincter, is likely to be painful for a week or ten days. The tissue should be just blanched, no more.

For hemorrhoids above the sphincter, the second method is very successful, as these hemorrhoids are poorly supplied with sensory nerves and have but little pain during the healing process. The latter type of cases, however, should only be treated in a hospital, as there is some danger of a secondary hemorrhage when the slough loosens, which will be in from one to two weeks after the coagulation.

Galvanism may be used for the treatment of hemorrhoids. The electrode in the bowels should be made of pure copper, cone shaped, covered with chamois skin and well moistened and lubricated with tragacanth lubricant (never use grease). This should be attached to the positive pole and gradually inserted into the bowel, pushing the hemorrhoid before it. The indifferent electrode may be placed anywhere on the body, preferably over the abdomen. The amount of current used is from 5 to 20 milliamperes and the time required will be from five to fifteen minutes each application, which should be once a week or twice a week. This method may also be used for prolapsed bowel and is very successful in many cases.

For prolapses of the bowel it is much better to use the d'Arsonval current, using electrocoagulation and running a line of coagulated tissue lengthwise of the bowel over the prolapsed portion, never laterally. These lines should first be run on the quarters; if further treatment is necessary, coagulate on the eighths and just deep enough to reach into the muscular tissue, not through it. This will produce cicatricial contraction of the tissue, which will draw the bowel within the anus and hold it there. The coagulation must not be sufficient to produce stricture or obstruction of the lumen.

Another method of using galvanism in the treatment of hemorrhoids is to use a fine common sewing needle which should be insulated to one-third of an inch from the point. This electrode is then inserted into the base of each hemorrhoid separately and enough current used to blanch the tissue, usually from three to ten milliamperes for two to five minutes. The needle electrode should be used on the negative pole, which produces blanching and alkaline or hydrogen gas bubbles. It may, however, be used on the positive pole, particularly for the hemorrhagic type. When so used, the action of this pole being acid, the tissue will be blackened instead of blanched and the eschar will be deeper and a little slower in healing. The current consumption will be the same. The indifferent pole in either case may be placed where most convenient and should be of composition metal not less than three by four inches in size and well covered with cotton, which should be saturated with a saturated solution of sodium chloride. The above treatment properly carried out is an ambulant treatment and produces very little discomfort.

Hemorrhoids themselves have very few complications, but the diseased conditions which are their etiological factors will offer an opportunity for one's best diagnostic ability.

The average length of time these cases will require treatment is from a few days to a few weeks by any method except surgery, which will remove the tissue in a few minutes and should be healed within a week or ten days. Most of the milder cases can be handled as an office treatment, while the more severe cases should be hospitalized.

The prognosis is always good, although recurrences may be considered probable for other veins may dilate or other capillaries rupture, and the condition that produces one set of hemorrhoids, if allowed to continue, will produce another set.

Papilla, Rectal.

Rectal papilla should be considered along with hemorrhoids for the itching, burning, pain, discomfort or distress as described by the patient may frequently be caused by papilla instead of hemorrhoids.

These are little sharp-pointed, connective-tissue, masses containing nerve filaments which are impinged as the tissue contracts, hence the reason for the amount of disturbance caused as compared with their size which is usually less than a centimeter at the base for the largest and many of them not much larger than a small pin head.

The papilla are usually located in the grasp of the external sphincter and when touched are usually as sensitive as a very sensitive clavius. They often produce symptoms very similar to neurasthenia and frequently are the etiology of sacral and lumbar backaches. Their presence may cause symptoms of many other disorders and when a case is intractable they should be looked for. As a rule, they can be found by digital examination followed by inspection through a proctoscope or suitable rectal speculum. Magnification will aid.

After being located in this way, specula of suitable size and shape will be required for treating any of these cases. When found they will be seen as a little mass of hardened tissue, blanched in appearance, freely movable with the mucous membrane. All that is necessary to eradicate them is to pick them up with a toothed forcep and snip them off at the base with a curved scissor. Unless blood vessels are cut, stitches will not be necessary. If one wishes to avoid any bleeding at all, use the Oudin current and desiccate the little mass or use the d'Arsonval current and coagulate its base. The end sought is to destroy the hardened mass of tissue with its over-adequate nerve supply.

The after treatment of all lower bowel conditions will be at least one daily movement of feces that are softened either by ene-

mas, mild cathartics by mouth or mineral oil in sufficient quantity to keep feces liquid or at least soft.

Anal Fissure.

Anal fissures should be considered with hemorrhoids as they frequently accompany them.

These are little cracks in the mucous membrane lining the anal orifice and within the grasp of the external sphincter. They may penetrate the mucous membrane and dip down into the muscular tissue, but this is seldom the case. They frequently bleed when the bowels move and, many times, are diagnosed without examination as bleeding hemorrhoids.

When found, their treatment consists of splitting the portion of the muscular fibers immediately beneath the fissure and parallel with it with a sharp knife or by the use of a hot spark from the d'Arsonval current, destroying the tissues to about the same depth as they would be if incised. This work may be done under a local anesthetic and usually should be all that is necessary, although at times with hysterical cases, it is necessary to use a general anesthetic. Gas or "Twilight Sleep" is best for this and consists of giving the patient one-fourth grain of morphin and one one-hundredth grain of hyoscin one and one-half hours before the time of the operation, repeating this dose three-fourths of one hour later. This is the average dose for the average adult in average health. It should not be used for patients under fifteen years of age and in old age it should be used with extreme caution and the dose varied to suit the individual, particularly if complete narcosis is desired. If narcosis is not complete when ready to operate, give ether continuously for three or four minutes until there is complete narcosis, then remove the ether from the room, thus avoiding any danger of explosion by the electric spark.

Case No. B77. Male, age 37. Was referred to us August 21, 1923.

Complained of pain in, and bleeding from, the rectum. Rectal examination disclosed a sharp pointed papilla as responsible for the pain and several small fissures accounted for the show of blood.

I removed the papilla under local anesthesia with a pair of curved scissors. The area was not stitched.

For the fissures, I used actinic rays from the water-cooled lamp giving treatments of from one to three minutes through a tubular applicator. Twelve treatments were sufficient to remove all symptoms.

DIAGNOSIS: Rectal Papilla and Anal Fissures.

Herpes Labialis and Facialis.

Herpes labialis is an acute eruptive disease characterized by the appearance of vesicles grouped over varying sized areas surrounded by a mildly inflammatory reaction.

It may occur upon any portion of the body but usually is found around the lips, nose, genitals, and buttocks. It is commonly associated with acute coryza, pneumonia, and the eruptive and febrile diseases. The vesicles are the result of irritation of the peripheral nerves. These irritations may come from a variety of causes which may be irritating nasal discharges or intense sunlight of the mountains or desert. About the buttocks and genitalia, they are frequently associated with the menstrual period.

The pathology is best described as a mild inflammation, and vesiculation. There is no destruction of tissue.

In diagnosis, it must be differentiated from impetigo, pemphigus, vesicular eczema, and dermatitis venenata.

The cardinal symptom is a vesiculation. It is accompanied by slight burning and itching. These cases will cure themselves in from one to two weeks. They need very little treatment.

Of drugs, camphor in the shape of the spirits or camphor ice is usually sufficient if applied locally. Some cases are definitely and rapidly benefited by the use of actinic rays from the water-cooled lamp, exposure a few seconds only.

Of complications there are none, although there are frequent recurrences. Many people are subject to these recurrences at short intervals. In these cases there seems to be a lack of calcium in the system and the internal administration of this drug is of definite benefit. Calcium chloride in doses of five to ten grains either by mouth or intravenously daily to weekly is a good method for its use.

Herpes Genitalis.

Herpes simplex is an acute, non-contagious, benign inflammation of the skin and mucous membranes usually dependent upon an accompanying neuritis.

It is characterized by groups of small vesicles which usually coalesce on an inflamed and edematous base.

While these spots may occur on any part of the body they are usually formed about the junction of the skin and mucous membrane either about the mouth, eyes, or vulva. Only in rare instances are they found wholly upon mucous membranes.

The etiology as already stated is usually a nerve irritation accompanying acute diseases. Herpes genitalis frequently accompanies the menstrual period and pregnancy. Uncleanliness and friction are contributing factors. Herpes is usually found between the ages of 20 and 50 and frequently occurs in the male and may be associated with venereal disease.

The pathology is a fibrinous inflammation of the epithelial layer of the skin with a slight coagulation necrosis beneath it. While it is benign and non-contagious, herpes must be very carefully differentiated from syphilis and chancroid which frequently

start in the same locations and may be accompanied by herpetic eruptions. Malignancies are to be thought of but as herpes tends to heal without treatment in about ten days, there is no need of being long in doubt. Herpes zoster is to be thought of but usually occurs on other portions of the body particularly the thorax and forms pustules instead of vesicles and comes independent of any febrile reaction.

The objective symptoms are the coalescing vesicles usually at or near the junction of the mucous membrane and skin.

The subjective symptoms are a slight burning and itching with the appearance of redness and edema followed by the vesicles within a few hours. Following the vesicular eruption there is a slight scab formation and some excoriation of the surrounding tissue. Should the vesicles or excoriations become infected with pus producing bacteria, abscess and scarring result. Hemorrhage into the vesicles is rare. In the genital cases, pruritis is a very prominent and distressing symptom and coalescing groups of vesicles are likely to follow one another for many weeks giving the disease the appearance of a chronic disorder.

The treatment should be as simple as possible for the disease tends toward immediate improvement; therefore the treatment should be directed toward the etiological factor and to prevent recurrences which are the rule.

For the genital herpes, extreme cleanliness must be insisted upon and all known irritations removed. Boracic acid and magnesium sulphate solutions may be used in these cases, after which the part should be thoroughly dried and the opposing surfaces kept from macerating by the interposition of cotton or wool or cotton over lamb's wool.

Actinic rays from the water-cooled lamp are of distinct value in these cases both to maintain asepsis and to hasten healing. This is particularly true if a calcium deficiency is an etiological factor, for the actinic rays help to fix calcium in the tissues. The actinic-ray treatments should be of short duration, about one-half minute at a distance of one inch, although in the severe genital cases the time may be cautiously lengthened to two minutes at the above distance.

The frequency should be daily.

The prognosis is good.

Herpes Zoster.

Herpes zoster is an acute disorder. It is characterized by groups of vesicles which follow definite terminal nerves usually upon the thorax but occasionally on other portions of the body.

Its etiology is undetermined. Theoretically it may be toxic, infectious, a traumatism, or due to a nervous phenomena.

Pathological changes have been found to be an inflammation of the posterior root of the spinal nerve thus accounting for its principal symptom—pain.

It must be differentiated from herpes simplex, impetigo, and eczema.

Its cardinal symptoms are the uniform distribution of the vesicles which umbilicate and are on an inflamed base and along a nerve trunk and the accompanying pain which increases in severity after the disappearance of the eruption. The pain may be delayed for a month or six weeks, on the other hand there may be a prodromal hyperesthesia or pain.

The general management of these cases is ordinary hygiene, a light diet, and a complete evacuation of the intestinal tract.

There is no surgical treatment for this disease and drugs are of little benefit. Used locally they are for the relief of pain.

Physiotherapy, however, offers the best method of treating these cases and of the physiotherapeutic modalities actinic rays are by far the best. An application of one or two minutes with the water-cooled lamp at a distance of one or two inches for the entire surface involved should be sufficient to stop the activity of the vesicles. Two or three such applications should clear the case with the exception of the pain some of which may last from two to four weeks. This, however, is benefited by the rays given. The air-cooled lamp may be used at a distance of three inches for about the same length of time.

The average length of time the case will need treatment will be from one to two weeks.

The prognosis is always good.

Hodgkin's Disease (Pseudoleukemia).

Hodgkin's disease is a chronic adenitis usually starting in the posterior cervical regions but may involve any or all of the lymph glands in the body. There is no tendency toward suppuration. There may be some splenic enlargement. There is a progressive secondary anemia with extreme weakness, occasionally there is fever. It occurs before the 40th year and usually in males.

Its etiology is still under discussion. Early it was thought to be malignant but if so its malignancy is of a low grade type, as the duration of most cases covers a period of several years. Bunting and Yates suggested *Corynebacterium hodgkini* as the name of the bacteria found in nearly every case and it is probable that this is the infecting organism.

Its pathology closely resembles lympho-sarcoma from which it must be differentiated. The glands are more discrete in Hodgkin's than in lymphosarcoma. Less frequently it must be differentiated from tubercular, leukemic, or syphilitic adenitis and from various mediastinal tumors.

The microscopic examination of a lymph gland will show an

increased amount of connective tissue, an increase in the number of lymphoid cells, giant cells which are multinucleated, and eosinophile cells; later there is fibrosis. The disease does not tend to invade the surrounding tissue.

The lymphosarcoma gland is composed of a delicate reticulum with cells larger than the lymphoid cells. The reticulum tends to invade the surrounding tissues by penetrating the gland capsule.

The diagnosis is based upon the finding of the *Corynebacterium hodgkini* and the blood picture. The erythrocytes are reduced to less than 2,000,000 and the hemoglobin to around 40%. Early the leucocytes number around 10,000, although late in the disease they may number 100,000.

The polymorphonuclear neutrophiles range from 75 to 92, the lymphocytes 5% or below, while the transitionals may be above 8%; usually their percentage is above that of the lymphocytes.

There is an increase in blood platelets, thus differentiating it from pernicious anemia, where they are decreased. Hodgkin's disease must be differentiated from tubercular and syphilitic adenitis; also from leukemia and the various mediastinal tumors of which it is one.

Treatment. There is little in the general management of these cases except to maintain the best possible general health.

Surgery offers but little for these cases and should not be used except to relieve extreme pressure symptoms.

Drugs in any form offer but little. Benzol failed to live up to its early reputation. Arsenic is still used.

Roentgen rays and radium are of decided benefit for relief. No known cures have occurred.

General visible light and actinic rays aid in maintaining the general physical condition and are of definite benefit in delaying the secondary anemia. As in the leukemias, the first roentgen ray or radium treatment is followed by marked improvement, while the later treatments are less active and finally fail altogether. They are, however, our best treatment at present.

House Maid's Knee or Occupational Bursitis.

House maid's knee is a chronic swelling of the prepatellar bursa, the result of repeated minor traumatism due to occupation. It is very chronic, the secretion accumulating slowly but gradually filling the bursa with serum giving fluctuation with but little discomfort until the tension becomes extreme, the pressure from within causing the pain.

Interference with work is the reason for seeking treatment.

For the vast majority of these cases, the treatment is very simple, consisting merely of a wet pack of magnesium sulphate (one ounce to a pint of water) used continuously if the condition demands immediate reduction. If not, used during the night only. This will usually reduce the swelling and ease the pain after the

first twelve hour application and these continued nightly for one or two months should restore the bursa to its normal condition.

Draining and packing are of little value in these cases for they tend to refill. However, if the bursa is very large and painful, it may be aspirated under aseptic conditions as a temporary measure, meanwhile treating it with the magnesium sulphate solution.

Case No. 10B. Female, age 47. Was referred for treatment December 15, 1915. She had a fluctuating mass about and below the right patella. There was no redness or edema and it pained her only upon pressure or flexion. The tumor had been gradually enlarging for several months.

Nocturnal applications of magnesium sulphate (1-16) solution for three months restored the knee to normal.

DIAGNOSIS: Prepatellar Bursitis (House maid's knee).

Hypertension.

Hypertension and hypotension are blood pressure conditions associated with various diseases or mental states.

Hypertension in the vast majority of the cases is associated with an arteriosclerosis and if above 180 systolic is, almost invariably, associated with kidney lesions, usually of the contracted kidney type, while the hypotension is usually associated with innervating diseases, of which tuberculosis, cancer, and typhoid fever are types. The normal blood pressure is roughly 100 millimeters of mercury, plus the age of the individual. There may be great variations from this and still be fairly normal. The normal pulse pressure should be about 40 millimeters of mercury.

With hypertension of 160 or over, one should look for arteriosclerosis associated with some form of chronic nephritis. The highest millimeter readings are found in the late stages and in uremic conditions. Hypertension is also associated with apoplexy and in these conditions the reading may be as high as 300 millimeters of mercury. Other conditions causing hypertension are syphilitic aortitis and thyrotoxicosis. Between 140 and 160 we have what Allbutt called "hyperpiesia," the etiology of which is undetermined.

In chronic heart lesion of the aortic regurgitation type, the blood pressure will be around 200, while the pulse pressure, which is more diagnostic of this condition, will range around 100 or over.

In cases of myocarditis, there is an initial rise of blood pressure, when exercise is taken, which is not maintained. Retinal and arterial changes in the eye are an accompaniment of the high blood pressure and are, many times, diagnosed with the ophthalmoscope before it is possible to do so with the sphygmomanometer.

Hypertension is associated with chronic valvular lesions in which there are complications. Hypotension is associated with

the acute infectious diseases as typhoid, pneumonia, diphtheria, acute diarrheas, and dysenteries. Early syphilis gives a hypotension, while late syphilis, especially during the gastric crisis, usually gives a hypertension, and always during the course of a syphilitis aortitis with regurgitation. All cases of shock, collapse, and continued hemorrhage show a marked hypotension.

Women between the ages of 40 and 60 frequently have hypertension ranging from 160 to 300 mm. of Hg.

The etiology in these cases has as its principal factors multiple gestations, worry, constipation with an associated gastric and intestinal indigestion, the menopause and widowhood. Endocrine changes are rapid during this period. In many of these cases, there is an absence of cardio-renal complications. These cases are what are usually known as "essential hypertension" cases, although the term may cover a mountain of ignorance.

In considering the treatment of hypertension or hypotension, it is absolutely necessary to consider the etiological factor producing either of these conditions and treat the etiology rather than the symptom, and anything that will modify the etiological factor will in turn modify the blood pressure. On the other hand, where there is a moderately high blood pressure with good compensation, treatment must be inaugurated with caution. It is not enough to treat every case of high blood pressure for the mere purpose of lowering it unless it is warranted by the diseased condition. If this can be modified without damage to the individual, the blood pressure will automatically be lowered or raised.

As to the treatment of hypotension cases with an etiology of acute infectious diseases, it is unnecessary to treat the hypotension at all, for as the case recovers the hypotension will automatically tend to rise to the normal. On the other hand, in the chronic tubercular and cancer cases there is neither need nor advisability of treating the hypotension. It will rise or fall only according to the progress of the disease. The same may be said of syphilis, neuroses, or shock from any cause, and in this condition it is used more as a diagnostic measure than as a demand for treatment, although in the main the reader is referred to the various diseases under their own headings for treatment rather than to give the treatment for the essential condition, hyper or hypotension.

In the main the two physiotherapeutic measures which give best results are general visible-light and actinic-ray treatments and autocondensation from a high-frequency machine, but these benefit the blood pressure reading only to the extent that they benefit the etiological factor.

In giving autocondensation, it is best to use a thick pad, for the reason that the patient is more fully saturated with the current. The amount of milliamperage will depend upon the voltage used. Ordinarily from 600 to 1000 milliamperes will be sufficient,

and the time required for each treatment will be from five to ten minutes—seldom longer. Long treatments of high milliamperage tend to extreme vasodilatation and cerebral anemia, therefore should be avoided.

Daily treatment should be given until there is a definite reduction of blood pressure, then less frequently. Usually one can reduce the pressure from 10 to 20 millimeters of mercury at each treatment. The most of this reduction should be maintained until the subsequent treatment, if the case will yield at all to autocondensation. If no reduction occurs in four or five treatments, some other measure will have to be substituted. When the hypertension is extreme (systolic 250 or over) do not attempt to lower it below 160. Again, if the pressure is around 180 systolic and 140 diastolic, with good compensation and good kidney function, do not try to change it. Let well enough alone. High millimeter readings per se do not call for autocondensation. Try to keep the pulse pressure around 40 mm. of Hg.

Regulated exercise is decidedly beneficial to these cases and outdoor life is to be advised. A decrease in the quantity of food eaten is essential. Proteins, as meat, eggs, etc., should be restricted or many times excluded. Milk, green vegetables, and fresh fruits make the best diet for these cases. The bowels should be kept loose.

Hysteria.

Hysteria is not a disease but an uncontrolled emotion either voluntary or involuntary; so behind the symptom, hysteria, is usually some mental or physical condition which causes the individual to lose control of himself or herself.

The usual etiology is extreme mental anxiety or sorrow over any condition, imaginary or real, and is at times but a means to an end. Where there is any underlying physical condition this, if possible, should be ascertained and corrected and if this etiological factor is one of the diseases which can be benefited by physiotherapeutic methods they should be used. This is especially true if the hysteria comes, after prolonged illness or serious operations or accompanies debilitating diseases, then general visible-light and actinic-ray treatments will be of immense value, particularly so if there is a secondary anemia.

Vibration, both general and local, is also of benefit in these conditions, provided there are not contraindications due to the physical disability found.

The pain areas may require the use of the d'Arsonval current as medical diathermy.

The drugs, except the nauseating ones, as asafetida, have but little influence upon a case of hysteria per se unless they are indicated for the underlying conditions.

The length of time these cases require treatment will depend largely upon the underlying etiology.

The prognosis, as far as the hysteria is concerned, is usually good, although the patient may be out of mental control for many months at a time. These cases require the utmost care and study in diagnosis to find, if possible, the underlying physical or mental disability.

Infections.

Infections cover an extremely wide field, involving, as they do, not less than 75% of all cases requiring treatment. There is not a tissue in the body that may not be involved by the various infective processes and by the multiplicity of bacteria. Seldom is a single variety of bacteria found, usually two or more different varieties of bacteria being involved in an infective process.

In the early stages of an infection, the blood picture will show a high polymorphonuclear leucocyte count if the immunity of the individual is up to or above the average, while in late infections there may be a high leucocyte count, there is almost sure to be a secondary anemia showing a low erythrocyte count and a low hemoglobin.

The pathology of all infections is a tendency to destruction of tissue either by abscess formation, ulcerations, or pressure.

Cardinal symptoms of all infections are pain, swelling, and redness, which are in varying degrees, depending upon the tissue involved and its blood supply; also upon its lymph drainage and the depth at which the infection is located from the surface of the body.

The positive diagnosis of an infection is the finding of the bacteria involved. This is not always possible. On the other hand it must be differentiated from traumatism, which gives much the same symptoms, but without infection, although infection may accompany traumatic cases.

The general management of an infection is the best possible hygiene, with exercise for the non-painful cases, and rest, more or less absolute, for the painful cases, particularly if accompanied by trauma. The diet recommended will be largely that which the individual's digestive apparatus is able to care for properly, therefore it may be anything from a simple milk diet to one which is heavy in meat or carbohydrates.

As the bowels take care of most of the debris of the body which is greater during an infective process than normally, they must be kept free, not necessarily loose or diarrheic, but there should be one or more stools daily.

The principal treatment of all infections is the immediate relief from part of the infection, if this is at all possible, and it should be at the earliest moment that it is possible to diagnose the case.

Drugs internally are often of great benefit in these cases, likewise those used subdermally, as the bacterines and vaccines. Their action is to increase what is known as the immunity and this is more or less of an uncertain quantity, which cannot always be prognosticated.

Intravenous injections are of the utmost value in the treatment of infections, particularly the deep ones and before pus has formed, although the patient is seldom seen at this stage.

Drugs that are used locally for infection are those which are bactericidal and therefore antiseptic. These are many and varied, one antiseptic or type of antiseptics being used in one community or hospital, and another type being used in another community. Another fact which influences the use of antiseptics is the routine of the individual. Once a practitioner of medicine finds a drug valuable he is liable to continue its use until something of a very much greater value is brought to his attention, therefore routine plays a great part in the use of various drugs by various individuals. The end sought, however, is to destroy the infection with the least possible irritation or pain to the individual infected. The antiseptic used should be effective and non-irritating.

Of the mild antiseptics found to be the most useful at the present time, boracic acid probably covers the widest field, aluminum acetate probably comes next. Both of these are used in a saturated solution and can be so used upon practically every tissue of the body, including the eye.

Of the newer antiseptics which are being brought out from time to time, the silver salts stand preeminent. Some of these are ages old; others are different types only, but the aim in the production of all of them is to get the highest bactericidal value with the least irritation and least staining property. Argyrol and lunosol are among the best of this type. Mercurochrome is a dye of undetermined value; while it possesses the good quality of being non-irritant, it possesses the bad quality of leaving a pronounced stain on anything it touches. Mercurochrome is used from $\frac{1}{2}$ to a 5% solution, while the silver salts are used in solution of from 5 to 25%.

Oil of turpentine is another good local antiseptic; while it is not wholly painless, it is not irritating after the first few minutes and is not destructive of normal tissues unless used pure and in constant contact. It has the added advantage of being hemostatic. While it should be used in about a 10% solution, in extreme cases of acute hemorrhage it may be used pure. It is best diluted with olive oil.

Magnesium sulphate, while not an antiseptic in the true sense of the word, is one of the best wet dressings we have for local applications to open wounds or even to closed wounds, especially those of the traumatic type and is best used in the proportion of one ounce to one pint of water. Temperature is not essential,

although it may be used as a hot or cold dressing. When used in a saturated solution for any length of time, many skins are likely to be irritated to the point of an eruption, which is similar to that of iodism.

Carbolic acid, while a good antiseptic, should not be used as a wet dressing for fear of absorption, which is very great—sometimes poisoning, particularly of the kidney, occurs. Bichloride of mercury, if used at all, must be used in a very weak solution, about 1 to 10,000. Ichthyol is at times of value in from a 2% solution in oil up to its full strength, but has the disagreeable feature of being odorous and staining everything with which it comes in contact.

The cresylic acid preparations are of value as antiseptics, but have the disadvantage of being irritant, poisonous, and extremely odorous.

While the preceding measures should be used in most cases, our most valuable agent in the treatment of infections is physiotherapy. Most of these cases will require a general visible-light and actinic-ray treatment with actinic rays from the water-cooled quartz-mercury lamp applied locally over the site of the infection if this is at all possible and it matters not whether the infection is superficial or deep although the superficial case is the more easily affected. The local treatment should be sufficient to produce a good hyperemia and frequently blistering is of value.

For deep seated infections as joints, lungs, etc., where a deep hyperemia is desired, diathermy is invaluable. This is particularly true where there is no pus or after drainage. It should not be used where pus is present until after surgery has brought all the relief possible, for diathermy tends to break down the limiting zone which nature builds around all infective processes.

As far as actinic rays are concerned, it matters very little whether the infected process is a superficial ulcer, a deep pelvic abscess, a bone abscess, lung infection, or what not, actinic rays are still the most valuable agent the medical man possesses to-day and can be used either before or after drainage. If used before pus has formed, the infective process may be aborted. General treatments are given either over the entire body or, as usually given, over the chest and abdomen, front and back, and this for the majority of cases is all that is necessary.

The visible-light treatment should, on the average, be ten minutes for each surface treated, while the actinic-ray treatments should be about one-half to one minute for the first treatment and increased one-half to one minute daily according to the reaction of the individual case. These treatments should be daily until definite relief is obtained, then less frequently. At no time should blistering be produced in giving a general treatment if it is at all possible to avoid it. Some individuals are so susceptible to the rays

that even a one-half minute treatment at a distance of twenty inches will produce a slight blistering; however, destruction of the deeper layers of the skin does not occur and no permanent damage is done beyond making the patient uncomfortable for a few days.

When treating infective processes, the treatment should not be discontinued because of the hyperemia of the skin, but the length of time the actinic rays are used should be materially reduced. If the time of the treatments has been three, four, or five minutes it should be reduced to one minute or proportionately. In this way the skin resistance is built up more quickly than if one waited for the hyperemia to recede, meantime the infective process would have the added advantage of delay.

If at all possible, use an electric-light bath-cabinet with an actinic-ray quartz-mercury burner inside. This will give the most perfect hyperemia it is possible to obtain, together with splendid elimination, and this in from three to fifteen minutes. In order to treat all sides of the body in the cabinet, it is necessary to have the patient seated on a swivel stool and turn slowly during the actinic-ray treatment, thus not only the torso but all surfaces of the extremities are affected by the rays. It must be remembered that a general-light bath-cabinet treatment is debilitating if carried on for any length of time and this must be taken into consideration when treating patients who are weakened by infective processes.

Influenza.

Influenza is a highly infectious epidemic disease occurring mostly in the winter seasons and pandemically every fifteen or twenty years with pronounced severity.

The etiology of this disease is bacterial and although the influenza bacillus (Pfeiffer bacillus) is found in over ninety per cent of the cases, yet it is not the only etiological factor as other bacteria of the streptococcic and staphylococcic types are found associated with it. Many times pneumococci and other infecting organisms are also associated.

There is no pathological picture characteristic of influenza, but usually it attacks mucous membranes first about the eyes and upper air passages and from these spreads to the deeper tissues particularly the central nervous system where it produces symptoms that are definitely toxic. As soon as the system becomes lowered in vitality, pneumococcus, streptococcus, etc., are liable to invade other tissues, especially the lungs, the pleura, and gastrointestinal tract, occasionally producing an inflammation of the brain or spinal cord. The symptoms are of rapid onset.

The prodromal symptoms usually consist of headaches, malaise, chilliness or actual chills followed by high fever and a rapid pulse usually accompanied by sore throat and cough. One of the first symptoms is pain and aching throughout the limbs and back with

accompanying headache. These pains are, many times, of sufficient severity to call for their alleviation before attending to the underlying condition. However they are of all grades of severity from barely attracting attention to all that a human being can stand. In children, during the epidemics of this disease, delirium is a common symptom associated with the rapid onset of the symptoms and the pain. There is an increase of the catarrhal secretion from the various mucous membranes.

These cases must all be differentially diagnosed from other inflammatory diseases, from simple coryzas and acute tonsillitis to lobar pneumonia, colds from simple infections, and acute tuberculosis.

All bacteria forming etiological factors of this disease may be the etiological factors of complications which accompany it.

The sequela may be inflammations of the various mucous membranes or organs of the body which may be anywhere from a simple gastritis to a true nephritis accompanied by myocarditis or an endocarditis with valvular lesions. The gastro-intestinal tract at times bears the brunt of the infection.

These cases all require the best hygiene possible as well as all the fresh air available and of this it may be said "the more the better." Rest in bed is not necessary for the mild cases. The more severe cases should be put to bed at once to conserve their vitality and energy. The diet of these cases should be light, mainly of fruit juices, vegetables, buttermilk, or sweet milk and cream. The bowels should be emptied at once by saline cathartics or castor oil.

Drugs internally are of value in these cases and among the best of these is eupatorium, gelsemium, bryonia, aconite, camphor, and the arsenite of antimony. Intravenously, sodium iodide 32 grains and guaiacol $\frac{3}{4}$ of a grain are of definite value. Locally, we use magnesium sulphate both in the nose and throat, at times substituting packs saturated with a ten to twenty per cent solution of argyrol. For an application over the chest, use magnesium sulphate in a solution of one ounce to one pint of water and it is of value if used continuously and by this we mean until all the more severe symptoms are relieved. The wet packs should be used at room temperature although they may be artificially heated if so desired. On the other hand, for pneumonic cases, ice may be placed in the solution to keep it cold. Strychnin in small doses is at times useful for nervous symptoms, and is best given as strychnin arsenite in doses of 1/100 of a grain three or four times a day. Cod-liver oil by inunction is a good treatment for influenza particularly in children and more especially so in those who are undernourished. Nothing in the drug line equals this method of treatment for this class of cases.

Headaches and pain in the back and the limbs are best relieved by acetanilid three and one-half grains, sodium bicarbonate one

grain, caffen one-half grain. This dose should be repeated every fifteen minutes for three or four doses, this for the average adult, after which it is usually possible to control the symptoms by the drugs already mentioned.

Influenza is a contagious disorder, so these patients should be isolated from other members of the family and community in order to prevent the spread of the disease.

For the ambulatory cases, either in the milder form or after the severe symptoms have passed and if the patient fails to regain his usual strength and vitality, physiotherapy offers much. General visible-light, which for the first few treatments may be given for one hour or more, and the actinic-ray treatments, the latter of which should be increased one minute daily until periods of ten minutes are reached, are of value. These prolonged visible-light treatments will relieve the deep congestion by bringing the blood to the surface, where it can be vitally influenced by the actinic rays, which, without doubt, change the chemical composition of the body cells thus rendering them toxic to bacteria.

Combined with this treatment should be a local treatment using the actinic rays from the water-cooled lamp. These rays should be thrown into the nose through a solid quartz applicator raying as much of the mucous membrane of the nasal cavities as possible. This local treatment should be followed by an application of the same rays to the throat covering not only the tonsillar fossae but the pharynx, soft palate, and mouth as a whole. The time should be about one minute.

The relief of pain with these treatments will surprise even those who are familiar with the benefits obtained from actinic rays. Often within twenty-four hours there is a definite improvement in the condition of the patient. These treatments can be given to all ages, but in the extremes of age the length of the treatment with the visible light should be shortened and the distance increased to avoid immediate exhaustion. However, it lasts but a short time and it need not deter further treatment. These treatments should be continued until the individual has regained his normal strength.

For the bronchitis which comes as a complication or should a pneumonia follow, diathermy through the diseased portion of the lung will aid very materially in producing resolution. As another complication, many of these cases will suffer from a severe toxic poisoning of the entire nervous system which may delay complete recovery of the individual for several weeks or even months. This condition is particularly marked in the aged. Here the general visible-light and actinic-ray treatments are of the utmost value and cannot be replaced by any other method of treatment or any other therapy. In these cases the intravenous injection of sodium iodide 32 grains, and guaiacol $\frac{3}{4}$ of a grain given one day and the intravenous injection of iron cacodylate $\frac{1}{2}$ of a grain, sodium caco-

dylate 2 grains and nuclein solution 16 mims. given the next day will aid materially in their recovery.

The average length of time that the acute cases should be treated will be from three days to two weeks; for the chronic cases from two weeks to two months or more.

If properly cared for, influenza cases should offer a good prognosis. The many fatalities which occur are principally among those which are either badly treated or not treated at all.

Intestinal Stasis, Auto-Intoxication with Visceroptosis, Constipation, Etc.

In most cases of intestinal stasis accompanied by auto-intoxication there will be found ptosis of various organs within the abdomen, sometimes of a single organ as with a floating kidney, sometimes a general visceroptosis.

There are several etiological factors pertaining to this condition: Relaxed abdominal muscles play a prominent part, emaciation is an added factor, while on the other hand, fat around the abdominal organs helps to drag them down. Emaciation following obesity leaves the various organs without support. Neurotic states seem to aid in the general relaxation. Frequent pregnancies followed by indolence cause a relaxation which is not corrected. Lack of physical exercise is a contributing factor.

The pathology is the ptosis plus congestion and various nerve irritations of the spinal and sympathetic nervous systems. In many cases these irritations simulate organic lesions and if one is not very careful in diagnosing them, they will be treated as organic lesions and probably not only without benefit, but with added symptoms which may be worse than the original condition. While every diagnostic method and aid must be used, we are finally dependent upon roentgenograms for the diagnosis of ptosis.

The differential diagnosis must be from gastric ulcer or carcinoma, the various diseases of the gall bladder and kidneys, the various leukemias and anemias with their various etiological factors. An enlarged spleen may drag down the colon and if adhered, the stomach likewise. Chronic dilatation of the stomach gives many of the symptoms of ptosis, so does colitis and the enterocolitis with which they may be associated. The various intestinal parasites must be remembered and the stool examined for them, their eggs, or segments.

Associated with visceroptosis are various pelvic congestions and rectal and anal disturbances. In short, in handling a case of visceroptosis one must treat the case as a whole and not merely the ptosis which after all is but a symptom of other and deeper pathology.

Treatment. The general management of these cases require your best diagnostic and therapeutic skill. Having excluded the

more serious pathologies, we find the treatment of the ptosis, congestions, and nerve irritations not surgical but physiotherapeutic.

The rectum and colon must first be cleaned out with enemas of soapsuds. If this is not sufficient, milk and molasses enemas (hot) or if in dire distress kerosene (one pint) makes an enema that usually gets everything. Smear petrolatum well up in the grasp of the sphincter and over the buttocks before giving the kerosene.

The sinusoidal currents are adaptable to most cases and should be applied with one pole over the spinal origin of the nerve supply of the organ involved. The other pole should be over the organ ptosed or a portion of it as the case requires. In treating the colon, use the anterior electrode first over the caecum, second over the hepatic flexure, third over the splenic flexure, fourth over the sigmoid. Each of these areas is given from five to ten minutes with contractions of from five to ten per minute. These treatments are given daily until there is a definite improvement, then thrice or twice weekly.

Occasionally interrupted galvanism is of definite value for its stimulative action. The current should be sufficient to be felt distinctly but not enough to be painful. It is, however, followed by the slow sinusoidal current. Both are followed by a general visible-light and actinic-ray treatment for its effect upon the general metabolism.

In some cases it is well to use a vibrator over the abdomen and spinal centers. These applications should be short, three to five minutes, or inhibition instead of stimulation will be attained.

Drugs do not seem to have any specific effect in these cases although at times the mild astringents or retention enemas seem to be of value. Fluid extract of krameria in from a five to a twenty per cent solution is advisable. Warm the solution and use about two ounces having the patient in the knee-chest position. The silver salts seem to aid some cases, likewise a 10% solution of calendula succus. The diet should be light and leave a minimum of residue until the organs have regained at least a part of their normal tonicity.

Sprains and Bruises or Injuries Short of Fracture or Dislocation.

These are all included under one heading as their treatment is similar.

Cases of fractures and dislocations must be set at the earliest possible moment and maintained in accurate apposition until healing takes place when these same methods can be used.

If the patient is seen within a few hours after the time of the injury, and there has been an X-ray examination to be sure there is not a fracture or dislocation, it is best to put the patient or at least the injured area under the visible light for one or more

hours. The distance should be sufficient to have the heat comfortable to the patient. This may be followed by mild massage or vibration with a soft rubber vibratode always stroking toward the heart.

For simple injury the above may be all that is necessary, but if there is much pain and swelling it is best to use magnesium sulphate (1-16) packs between the light treatments which should be daily until the patient is symptom free.

For the patient who is not seen for several days after injury, this same treatment may be followed but the visible-light treatment should be for one-half hour followed by mild massage and diathermy one applicator covering the entire area, if this is possible, the other over a part as nearly opposite as it can be placed. The milliamperage should be the patient's tolerance but will be about fifty milliamperes per square inch of the smallest electrode. Extreme care should be used to assure an absolute coaptation with the skin.

In some cases it will be impossible to place the electrodes over the injured area, then ingenuity will be needed to get the heat through the injured part.

A good method about joints is to place one electrode on the posterior surface above or below the joint, the other on the anterior surface above or below the joint but on the opposite area. This will drive the heat through the joint without coming in contact with it. Other areas may be treated likewise. The cuff or double cuff method is not very satisfactory but at times it is necessary to use them until a proper application of the electrodes can be made.

At times, particularly for fingers or toes, metacarpal or metatarsal joints, it is best to use a basin of water for one electrode. This basin should be of glass or crockery as it is difficult to keep the member away from the surface and if it touches a metal surface there will be a short circuit with an unpleasant shock.

Occasionally the slow sinusoidal current will aid in the restoration of muscle action.

The advantages of physical methods of treatment are: first, a quick relief of pain which occurs many times during the first treatment; second, the quick subsidence of the swelling due to the absorption of the lymph exudate; third, less fixation of muscles; fourth, much less loss of time; fifth, less permanent disability due to fibrosis of the exudate.

Ununited fracture cases should be fed on an anti-rachitic diet and be given daily general visible-light and actinic-ray treatments.

Impetigo Contagiosa.

Impetigo contagiosa is an acute contagious inflammatory disease of the skin usually found upon the face or neck, although it

may be upon the hands or any other portion of the body. Most of the cases occur on children although adults are not exempt.

Its etiology in the vast majority of cases is the staphylococcus pyogenes aureus although, at times, streptococci are found in the lesion along with other bacteria.

Its pathology is a superficial inflammation of the skin due to the infection and by a well outlined scab formation which has the appearance of being stuck on. The lesion is usually superficial, therefore does not leave much pitting or scarring.

It must be differentiated from barber's itch or tinea trichophytinea, ecthyma which is very similar although is found in larger patches, and ringworm, all of which, however, have their essential differences and no mistake should be made.

The general management of these cases requires special care so the infection is not spread from one individual to another which is usually carried on the hands or nails, or upon wash cloths, towels, etc. Extra precautions are necessary as these individuals are not really sick, but they are carrying a local infection which is transferable.

The treatment of this condition is entirely local and all treatment should be toward the destruction of the infection. If the individual is undernourished, special attention should be given to the diet. While moist dressings of aluminum acetate in a saturated solution are useful, daily treatments with actinic rays from the water-cooled lamp to each individual spot and surroundings for a period of about thirty seconds will usually be sufficient to clear up these cases in a few days.

Ischiorectal Abscess.

Ischiorectal abscesses are due to infection within or without the rectum. These infections are spread by the lymphatics into the fossae, which are the usual site of rectal abscesses. They are usually acute and give the usual cardinal symptoms of infection, which are pain and swelling with redness as the infection approaches the surface.

These infections are both acute and chronic. The chronic are almost invariably tubercular in origin.

Their diagnosis is usually simple but they must be differentiated from other painful rectal troubles or injuries about the pelvis. If allowed to progress unaided they rupture into the rectum or externally through the integument about the buttocks, usually within an inch or two of the anus, and many cases rupture both internally and externally and thus are the etiological factors of complete fistulae.

The general management of these cases requires a good hygiene, with rest during the pain period which should be short

as these cases should be opened surgically at the earliest possible moment.

Drugs in any form have but little influence upon them, but at times carbolic acid or silver nitrate are of value in destroying the lining membranes of the fistulae (see *Fistula*, page 237) which follow these abscesses.

After the surgical treatment, physiotherapy offers valuable aid in clearing up these cases. Actinic rays from the water-cooled lamp should be thrown not only over the opening of the fistulae but over the entire ischiorectal fossa and particularly over the tract of the sinus.

The average length of time these cases require treatment will be from one-half dozen treatments up to several months.

The prognosis is usually good although fistulae may follow.

Keloid.

Keloid is a new growth of connective tissue at the site of a skin injury, which may be the result of a simple traumatism from any cause or from surgery.

The pathology is the continued formation of connective tissue after healing has taken place and this may go on for years forming various sized tumors. These are composed entirely of connective tissue.

The symptoms are entirely objective and consist of a raised thickened portion of skin about the site of a former injury. The color is usually white, although it may be pink, but seldom of darker color.

The diagnosis is usually simple and the only disease likely to be confused is callosity.

Its treatment is entirely X-ray or radium, for any surgical, drug, or physiotherapeutic method which would injure the tissue in any way only adds to the rapidity of its growth.

X-ray treatment should not be over one-half of an erythema dose. The radium treatments are best given by using 50 milligram packs consisting of $\frac{1}{2}$ millimeter of brass, 1 millimeter of lead, and 2 millimeters of rubber. These should be kept in contact with the surface for one to two hours and not repeated as long as there is improvement, usually one to two months.

The length of time keloids require treatment will depend entirely upon the size of the growth and its location; usually several applications are required to absorb this connective tissue.

The prognosis is always good as to life, but some cases do not yield readily to radium, therefore only a portion of the growth can be removed. Treatment is usually demanded for cosmetic reasons.

Case No. 541. Female, age 22. May 16, 1922, she gave a history of a thyroidectomy two years previously. The incision for

its entire length was overgrown with scar tissue which was about $\frac{1}{2}$ to $\frac{3}{4}$ of an inch wide and about $\frac{1}{2}$ inch high, red to pink in color and somewhat sensitive to palpation.

Radium treatments were advised and accepted. Her first treatment on June 7, 1922, was packs of radium containing 50 mg. each to cover the entire scar and these were kept in contact for two hours. The packs were made up on 1 mm. of brass, 2 mm. of lead, 1 cm. of leather and 1 mm. of rubber for screening. Ten milligram needles were used in making up the packs which were applied for two hours.

Her second treatment was August 4, 1922, with a similar amount of radium and screening applied for three hours. There was some improvement from the first treatment but more from the second. The third treatment, September 25, 1922, and a fourth on November 13, 1922, reduced the scar to the level of the skin. The texture was more pliable and the color lighter.

DIAGNOSIS: Keloid.

Krameria.

Krameria or rhatany is an astringent of very great value in the treatment of chronic bowel conditions especially diarrhea, dysentery, and colitis, all of which may be associated.

This drug is best used as a retention enema using the fluid extract in from a five to a twenty per cent solution. This is also useful for leucorrhoeal discharges and fissures and very small urethral caruncles. It is also of use in gingivitis. For these conditions it is best to apply the fluid extract locally, undiluted. It should be thought of for all irritated mucous membranes. Its astringent action is due to rataubia tannic acid.

Laryngitis.

Laryngitis may be either acute or chronic. Most of the acute cases have as etiological factors infections which have spread from the upper or lower air passages. A sudden chilling of the surface of the body is an etiological factor, but this alone is not active without the bacteriology already mentioned.

Chronic laryngitis is usually a result of prolonged irritation due to new growths or tuberculosis, malignancy, or syphilis.

From the etiology, one can readily see that the pathology is anything from the slightest congestion or inflammation of the mucous membrane of the larynx to membranous diphtheria, or tubercular growths, secondary to pulmonary tuberculosis, to slight ulceration or thickening in the case of syphilis, to destruction of the larynx as a whole in the case of cancer. The latter is the only one which metastasizes into the surrounding cervical lymphatic glands.

This condition must be differentiated from the laryngismus

stridulus of tetany or diphtheria, edema of the larynx from any cause, aneurism of the arch of the aorta, and enlarged thymus either in infants or adults.

The cardinal symptoms of acute laryngitis are pain or discomfort in the larynx accompanied by hoarseness and if the edema supervenes, laryngismus stridulus. Other symptoms accompanying this condition will depend upon the etiology and the amount of destruction, but usually they range from hoarseness to complete loss of voice together with more or less of a fetid odor during exhalation depending entirely upon the etiological factor. If acutely infective, the patient will run a low grade temperature, usually around 101° F., with a pulse around 110. Following the subsidence of acute symptoms, aphonia may develop which will usually run from a few days to a few weeks but unless there is destruction of the vocal cords, it may be considered temporary.

The laboratory findings will be that of the existing bacteriology and pathology.

The diagnosis will depend upon the history, symptoms, and visual inspection of the larynx and the underlying etiology.

Naturally the general management of these cases will cover a wide field which will again depend upon the etiological factor and the management of this condition.

In the treatment of acute laryngitis, surgery has nothing to offer unless the infection extends outwards into the lymphatic glands with abscess formation. For chronic laryngitis, surgery has but little more to offer except as a palliative measure unless it be for the removal of benign growths.

Drugs are a distinct aid in treating the acute laryngeal cases. Internally such drugs as belladonna, causticum, aconite, atropine, etc., will be of distinct value. Intravenously sodium iodide 32 grains and guaiacol $\frac{3}{4}$ of a grain will aid. Locally ice cold packs of magnesium sulphate solution, one ounce to a pint of water, are of distinct value.

For the acute type, physiotherapy offers a distinct aid in the use of visible light for prolonged periods, one-half to one hour, followed by actinic rays for general treatment and locally over the pharynx, tonsils, and pillars, in fact the entire area of the upper air passages and in some cases the rays should be thrown into the larynx by the use of a curved quartz applicator attached to the water-cooled lamp. This is particularly true of the tubercular case where the rays are of the utmost value and exceeded by no other measure. Syphilitic cases must be treated entirely by intravenous medication or inunction, seldom by internal remedies and then usually arsenic or mercury in some form.

The malignant cases should be treated with X-ray or radium; X-ray by cross fire, radium by pack and cross fire, but seldom by the introduction of radium emanation seeds or bare needles into

the tissue of the larynx or those surrounding the larynx. On the whole, we feel that laryngeal malignancies should be treated from the outside and not from within. In this way, one obtains the greatest palliation with the least discomfort or pain.

The malignant cases usually offer a hopeless prognosis except for palliation.

Complications of the acute cases are usually an extension of the infection down the trachea into the bronchi and lungs. The tubercular laryngitis is usually secondary to pulmonary tuberculosis.

Syphilitic laryngitis will usually have complications in other parts of the body and they may be in any part of the body, as this lesion is usually tertiary.

The malignant cases are usually primary and have as complications the involvement of the cervical and mediastinal lymphatic glands.

The average length of time that an acute case will require treatment is usually a few days at most. For the chronic infective laryngitis, a few weeks will be all that is required. Tubercular laryngitis will require months of treatment, syphilitic laryngitis from three to six months, the patient two years, and the malignant will require palliative measures until the end.

The prognosis of the acute cases is always good except when complicated by edema or abscess formation. From the neighboring lymph glands these abscesses may spread downward along the muscles and carotid sheath into the mediastinum with fatal results.

The prognosis of the tubercular case is fair if treated by physiotherapeutic methods. The prognosis of the syphilitic is good so far as the larynx is concerned, while the prognosis of the malignant case is hopeless in all cases, although they may be palliated for one, two, or more years.

Leucorrhea.

While leucorrhea is but a symptom, it is of sufficient importance to require a separate heading.

It has for its etiology any condition of the vagina or uterus which will produce irritation, congestion, or inflammation, which in turn is followed by the discharge known as leucorrhea. Secondary anemias with loss of weight and exhaustion will frequently produce a milky leucorrhea and this is usually vaginal. Cervical tears are frequent etiological factors.

The pathology may be simple irritations or ulceration of the vagina, a gonorrheal vaginitis, cervicitis, or endometritis, a submucous fibroid tumor, subinvolution with its coexistent congestion, and all malignant or venereal lesions affecting the lining of the uterus or vagina.

Vaginal ulcerations may be simple, tubercular, syphilitic or malignant. The simple ulceration may be caused by irritants,

usually those used in douches, as lysol, carbolic acid, etc., or from the prolonged use of pessaries or other contraptions for the prevention of conception.

The blood picture will be that of the underlying etiology.

The cardinal symptom is, of course, the discharge. The accompanying symptoms are pain, the location of which will depend upon the etiological factor. The rectum and bladder are usually involved in this inflammatory process and pain may be referred to either or both of these organs. If the discharge is milky, it probably comes from the vagina; if it is stringy and glutinous, probably from the cervix; if purulent, it probably comes from the endometrium. If there is ulceration of any portion of the genital tract, there will be blood, either occult or macroscopic.

The diagnosis of the underlying etiological pathology must be made before treatment is begun, for to treat a leucorrheal discharge without treating the underlying pathology would be the height of folly.

The general treatment of these cases will be a good hygiene; plenty of exercise if it does not increase the pain, and this exercise should be taken outdoors if possible; rest, if there is pain or inflammatory lesions; a diet largely of fruit and vegetables and the bowels must be kept free but not loose.

Treatment. Subinvolution and cancer of the body of the uterus will require surgery, radium, or X-ray. Cervical tears will require trachelorrhaphy. Tuberculosis will require intravenous medication; sodium iodide, 32 grains, and guaiacol $\frac{3}{4}$ of a grain, is one of the best, and sometimes the internal administration of calcium and iodine. Syphilis will require intravenous, subdermal, or inunction medication.

The drugs, used locally, particularly for douches, should not include those that irritate, as lysol, bichloride of mercury, carbolic acid, etc.

For the simple cases or even for the malignant ones, nothing is equal to the magnesium sulphate, one ounce to a quart of water, as a douche; or magnesium sulphate, saturated solution, twenty-five per cent in glycerin, used as a local application. When there is a good deal of odor, a ten per cent solution of oil of turpentine in olive oil will act as a deodorant and so far has proved non-irritating. For the gonorrheal vaginitis, one of the silver preparations or one of the dyes may be used with benefit. It is best to paint these over the surface rather than use them for irrigation. The silver preparations are used in from 10% to 25% solutions; the dyes in from $\frac{1}{2}\%$ to 5% solutions.

The best physiotherapeutic treatment is general visible-light and actinic-ray treatments with local actinic-ray treatments from the water-cooled quartz-mercury lamp applied to the lesion. The cause of the irritation must be removed.

If there is cancer of the cervix, radium is probably the best treatment. Insert four twelve and one-half milligram needles into the quarters of the cervix or mass if it is impossible to find the cervix, where they should remain for twelve to twenty-four hours. This treatment should be followed in about two or three weeks by inserting the needles into the eighths, and after another month or so, one or two twenty-five milligram tubes of radium sulphate screened with silver, brass and rubber should be inserted into the cavity of the uterus and left for a period of twenty-four hours.

Simple leucorrhea will require very little local treatment except cleanliness.

Tuberculosis and the gonorrheal irritation and inflammation, including a simple ulceration, can be treated advantageously with actinic rays from the water-cooled lamp for a period of two minutes, using a proctoscope to avoid burning the vulva and dilating the vaginal walls with a bivalve speculum in the usual position. Through this the latter walls may be treated, then the speculum is rotated one-fourth for a like period of time. When so rotated the anterior and posterior walls may be treated, together with the urethra and Skene's glands.

The complications will naturally depend upon the etiological factors.

The length of time these cases will require treatment will depend upon the etiology. Malignancy must be watched for years. Syphilitic leucorrhea should be well in a few months. Tuberculosis will take from six to eight months, while simple vaginitis and accompanying leucorrheas should be well in from two to six weeks.

The prognosis of course depends upon the etiological factors.

LEUKEMIA.

Leukemia, Acute Lymphoid.

Acute lymphocytic leukemia is usually found in children, although it may be found in adults, and resembles an acute infection, for there is pain through various organs of the body and the weakness is prostrating. It differs from acute infective processes because hemorrhages are common and may occur from any of the mucous membranes of the body; many times this is the first symptom to be encountered. With it is a temperature range of 100° to 104° F. with a generalized edema and marked dyspnea. Retinal hemorrhages and tonsil ulceration are common.

In the acute leukemia, the liver, spleen, and lymph glands are all enlarged, but not markedly so, as in the chronic type.

Its etiology is unknown and its tissue pathology has already been given. It is neither contagious nor infectious.

The blood picture is characteristic of the disease and without a blood examination it is almost impossible to diagnose these cases.

In the acute leukemias, the leucocytes range is from 50,000 to 300,000 and in the differential count the lymphocyte count will be found to be around 98%, with the large cells predominating; these, with the Rieder cell, are pathognomonic. The polymorphonuclears make up a very small percentage. The eosinophiles and the myelocytes are usually a fraction of one per cent. The red cell count usually remains fairly high in the neighborhood of 3,000,000, but has been known to fall as low as 1,000,000. The hemoglobin is reduced to about thirty per cent. The disease runs a very rapid course, usually terminating in death in a few weeks, or at most in three or four months.

We have no treatment for the acute lymphoid leukemia that will stay the progress of the disease. X-ray might be tried, but as the disease is throughout the entire body, the treatment would have to be general and an overdose could easily be given. If used at all, it should be with extreme caution.

Leukemia, Chronic Myeloid.

Chronic leukemias are of two types, the myeloid and the lymphoid type.

We know absolutely nothing of the etiology. Infection may have something to do with the disease, but it has not been proved. The thymus and lymph glands may have some etiological force, as may the endocrine system or some particular part of it, but it has not been proved. From this point on we separate the two varieties of chronic leukemia.

In the myeloid type the pathology is usually that of an enlarged spleen. A definite liver and spleen enlargement of from one to three finger breadths below the costal arch will be found upon examination. Frequently the spleen will nearly fill the lateral half of the abdominal cavity. There are changes of bone marrow in the long bones and sternum.

The blood picture, however, is a clue to the disease and without the blood examination it is frequently impossible to diagnose these cases. In the myeloid type, all of the white cells are increased early in the course of the disease. The polymorphonuclears will range from thirty to sixty per cent; later they are decreased as the myelocytes increase; the small lymphocytes from one to five per cent; the large lymphocytes from three to thirty per cent; the eosinophilic myelocytes from one to ten, and the neutrophilic myelocytes from thirty to fifty per cent, thus it is readily seen that in this disease the diagnosis depends upon the very large number of myelocytes. Mast cells may be found. The white cells will range from 100,000 to 500,000 and occasionally as high as 1,000,000. Lymphocytes are few in number. Early in the myeloid type of leukemia the erythrocytes are but slightly diminished;

later they may be as low as 1,000,000. Nucleated red cells are common and in advanced cases the hemoglobin will be fifty per cent or less.

The cardinal symptom of myelogenous leukemia is the blood picture and particularly the enormous increase of neutrophilic myelocytes. The usual symptoms are those of mild infection, which is prolonged over several months of time, accompanied by a general progressive weakness, with loss of appetite, loss of weight and increasing dyspnea. With the loss of appetite comes nausea and frequently vomiting. Pain is noted in many parts of the body and headaches are common. As the disease progresses, edema and dyspnea become the characteristic symptoms. Fever is present at times in every case. This ranges from 100° to 105° F. and may last but a few hours or a few days. The bone marrow is involved early and the changes are progressive.

The diagnosis will be based upon the blood picture, and upon this it is usually easy, as most of the cases are not seen early.

Myelogenous leukemia must be differentiated from the lymphoid type of leukemia; also from Hodgkin's disease, pernicious anemia, chronic malaria and all diseases with splenic enlargement, from severe septic infections, tertiary syphilis, carcinoma and sarcoma, none of which will give the characteristic blood picture of myeloid leukemia; therefore with an accurate blood count there should be no trouble in differentiating it from the diseases just enumerated.

Leukemia, Chronic Lymphoid.

Going back to the chronic lymphoid leukemia, we find it less common than the myeloid.

In pathology it gives less disturbance of the spleen and liver, decidedly more disturbance of the lymphatic system, particularly the lymphatic glands throughout the body. The lymph glands are much enlarged but are movable and are separated from each other, and to this extent differentiates itself from Hodgkin's disease, where the lymph glands are enlarged and more or less massed together as the disease progresses.

Here again the blood picture is the pivotal point upon which the diagnosis must be made. The erythrocytes are reduced to between 2 and 3 million. The leucocyte count is high, as in the myeloid type, ranging from 10,000 to 1,000,000, with an average of about 100,000, while in the myeloid type the average will be between 200,000 and 300,000 total count.

The differential count will establish the positive diagnosis, for here small lymphocytes range from fifty to ninety-eight per cent, as against eighty to ninety-nine per cent of myelocytes in the myeloid type.

The accompanying table will give the differential points and characteristics:

Acute lymphoid of children		LEUKEMIAS	
		Chronic Lymphoid of Adults	Chronic Myeloid of Adults
Onset.....	Rapid.	Insidious.	Very insidious.
Frequency.....	Very rare.	Rare.	Common.
Course.....	Rapid, a few weeks.	1 to 2 years.	Slow. 1 to 10 years.
Fever.....	100 to 103 F.	Slight.	101 to 105 F. during exacerbations.
Hemorrhage....	Common.	Very rare.	Late, usually into spleen.
Lymph glands...	Slightly enlarged.	Much enlarged, mostly cervical.	Slight enlargement.
Spleen.....	Slight enlargement.	Slight enlargement.	Very much enlarged.
Tonsils.....	Swollen and they may be ulcerated.	Slight enlargement.	No enlargement.
Hemoglobin.....	30%.	70%.	80%.
Color index.....	Low.	Slightly sub-normal.	Low.
Erythrocytes....	Early 3 million. Late 1 million.	3 to 2 million.	Early 4 million. Late 1 million.
Leucocytes.....	25000 to 300000.	10000 to 250000. Average 100000.	100000 to 1,00,0000 late.
Lymphocytes....	Large cells predominating and diagnostic. 90 to 98%.	Small cells predominating, 70 to 98%.	Large cells predominating 1 to 30%.
Myelocytes.....	0 to 5%.	0 to 5%.	30 to 50%.
Myeloblasts....	.....	.....	Rare.
Rieder's cells...	Diagnostic.	.....	.....
Lymphoblasts...	Diagnostic.	.....	.....
Polymorphonuclears.....	Few.	Rare.	Early 60%. Late 30%
Normoblasts....	0 to many.	Rare.	Common.
Megaloblasts....	None.	.....	In acute myeloid common and diagnostic and rapidly fatal.

The polymorphonuclear cells are greatly reduced in number, while the myelocytes may or may not be present at all. Red-cell count usually varies from two to three million in the lymphoid leukemia. The normoblasts are very much increased, while the

megakaryoblasts are rarely found, and poikilocytes are common. The hemoglobin is reduced, but to a less extent than in the myeloid type. Here again this disease must be differentiated from those mentioned in the myeloid type, and also the diagnosis must be made upon the blood picture and not upon symptoms or general pathology.

The general management of both these types of chronic leukemia must be the best possible hygiene, exercise regulated to the strength of the individual patient, rest in bed during the time of high temperature, a diet that is light and largely of vegetables and fruit or milk. The bowels must be kept free, but not loose, to eliminate all toxins possible.

In the treatment for the various leukemias, surgery has failed except as a palliative for a short period of time, usually a few months, at most one or two years. Drugs in every form have likewise failed. X-ray in limited doses seems to temporarily benefit. Radium in the myeloid type seems to be better than X-ray. The dose should be about 150 milligrams for three or four hours, using 50 milligrams in a pack with sufficient screening to prevent skin erythema.

When radiating leukemic cases with X-ray or radium it is not necessary to ray the spleen or long bones. The raying of the blood stream, preferably over the mediastinum, gives as good results because it is the blood stream we are trying to influence and particularly the white cells, and for this reason it is possible to ray the blood stream after splenectomy and still get palliative results.

Human blood drawn in an aseptic glass syringe and immediately injected subcutaneously (up to eight ounces) may be of value in staying the progress of the disease.

Physiotherapy seems to have a definite beneficial effect in prolonging life. One case we had under treatment for over six years. He was able to go on with his work, supported himself and wife during most of this time, although the white blood count was over 320,000, yet his condition was fairly good as far as comfort and ability to labor were concerned. In this case the treatment was general visible light and actinic rays daily for several months, then three times a week, later twice a week, below which we were unable to go without having a recurrence of fever, dyspnea, and general weakness. He had a few treatments of radium, using three 50 milligram packs over the spleen for periods of three or four hours. This would rapidly reduce the size of the spleen and for a few months he would be much more comfortable.

It must be remembered that gamma rays give relief only, not cures, and one must also remember that the system builds an immunity against gamma rays, so that after a few treatments they fail to give relief and from this time on the progress of the disease is rapid.

The average length of time that these cases require treatment is for the entire life, as none of them have been known to be cured. Periods of recession of the disease are common and should not be mistaken for cures or improvement due to treatment.

The prognosis is hopeless as far as life is concerned, but if properly cared for and given proper physiotherapeutic treatment and moderate doses of X-rays and radium, life should be prolonged for several years.

The average length of time these cases live without treatment is from 6 months to 2 years. Osler quotes a case that lived for 10 years after diagnosis was made. This, however, is very unusual.

The complications during the course of the disease are infections, hemorrhage into the spleen, softening of the bone marrow, fatty degeneration of the heart. Hemorrhage into the spleen, however, is the most common and may be the cause of sudden death.

Case No. 64. Male, age 50. He came to us September 1, 1916, with a history of pain in his legs for some months past. He tired so easily that by 11 A. M. he could scarcely work and was extremely irritable. He had lost thirty-five pounds in weight. His appearance was the cachexia of one seriously ill, with the apprehension of one who does not expect to get well.

His blood count on September 8, 1916, was:

Erythrocytes	5,100,000
Leucocytes	146,000
Hemoglobin	95%
Myelocytes	20%

On September 26, 1916, the count was:

Erythrocytes	4,000,000
Leucocytes	320,000
Hemoglobin	80%
Myelocytes	34%

On November 20, 1916, the count was:

Erythrocytes	5,260,000
Leucocytes	201,000
Hemoglobin	82%
Myelocytes	17%

On December 23, 1916:

Erythrocytes	5,220,000
Leucocytes	182,000
Hemoglobin	95%
Myelocytes	30%

On April 10, 1917:

Erythrocytes	5,000,000
Leucocytes	175,000
Hemoglobin	90%
Myelocytes	18%

The treatment of this case was begun by giving a two-minute exposure to actinic rays, and the exposure was increased one minute a day until we were giving a ten-minute treatment. The interval gradually lengthened until he was getting but one treatment a week. When we began the treatment, he could scarcely walk a block, but he gradually improved, until April, 1917, he could walk seven or eight miles a day. His spleen, when he began treatment, was within 8 cm. of the median line and about 4 cm. below the costal margin. In April, 1917, it was normal in size. In September, 1916, his long bones were extremely sensitive to touch, but in April, 1917, they were not even tender, and as he expressed it, "I do not know, as far as my sensations are concerned, why I am taking treatments."

In July, 1917, he left Chicago, returning once in two weeks for treatment and observation. In July, 1918, after overworking, he had a relapse, running temperature as high as 103°, and the spleen was enlarged until it filled one-fourth of the abdominal cavity. His skin was very sensitive, but there was no return of the pain in the bones.

He resumed his general actinic-ray treatments and these were continued for the remainder of his life. They were given at varying intervals from daily during the acute exacerbations to twice weekly. The latter were usually sufficient to keep him in physical condition to continue his work.

November 26, 1918, the blood count was:

Erythrocytes	4,462,000
Leucocytes	160,000
Hemoglobin	75%
Myelocytes	18%

December 31, 1921:

Erythrocytes	4,384,000
Leucocytes	201,000
Hemoglobin	70%
Myelocytes	46%

During the latter part of 1921, the spleen enlarged rapidly and he died January 30, 1922, of splenic hemorrhage.

After starting the treatments he lived 5 1/3 years, and during most of this time he was able to support himself and his wife.

DIAGNOSIS: Myeloid Leukemia.

Case No. 335. Male, age 60. Came to use December 17, 1924. At this time there were large open sores both above and below the right knee, anterior surface. These areas were about 4x5 inches in size (see picture), the upper one extended into the muscles, the lower one to the tibia and both were exceedingly painful. He reported that these sores followed X-ray treatment for leukemia.

His blood count December 17, 1924, was:

Hemoglobin	65%
Coagulation time	5 minutes
Erythrocytes	4,250,000
Leucocytes	79,500
Polymorphonuclears	62%
Small lymphocytes	5%
Large lymphocytes	2%
Myelocytes	30%
Basophiles	2%

We found it necessary to remove the degenerated tissue, both above and below the knee by electrocoagulation, using the d'Arsonval current. This was followed by daily visible-light treatments for ten minutes and actinic rays beginning at two minutes and increasing to ten.

Following the electrocoagulation, there was some edema about the knee but this gradually disappeared. The daily light treatments were continued for thirty days, then they were given three times a week.

The blood count on March 4, 1925, was:

Hemoglobin	75%
Coagulation time	4½ minutes
Erythrocytes	3,400,000
Leucocytes	245,000
Polymorphonuclears	40%
Small lymphocytes	10%
Large lymphocytes	1.5%
Myelocytes	27%
Eosinophiles	1%
Basophiles	2%

In July, 1925, the spleen had enlarged so that it was slightly below the umbilicus. On August 15th and 16th he was given twenty-six hours of radium over the spleen. One hundred fifty milligrams in three packs were used over fifteen areas making a total of 3900 milligram hours. These 50 milligram packs were screened with ½ mm. of brass, 1 mm. of lead, 2 cm. of leather.

His blood count July 9, 1925, was:

Hemoglobin	45%
Color index	0.9%
Erythrocytes	2,590,000
Leucocytes	505,000
Polymorphonuclears	48%
Small lymphocytes	2.5%
Large lymphocytes	1%
Myelocytes	30%
Indentate nucleus	3%
Eosinophiles	2.5%

Basophiles	4%
Unclassified	9%

(Signed) National Pathological Laboratories,

J. J. MOORE, M. D.

The open sores on his right leg were nearly healed at this time and he was able to be about and help himself. The condition of the spleen and the blood count continued to vary and on February 8, 1926, he died.

DIAGNOSIS: Myeloid Leukemia complicated with Gamma-ray Necrosis.

Leukoplakia.

Leukoplakia is a chronic mucous membrane disorder, usually involving the mucous membrane of the tongue, buccal cavities, gums, or lips, although it may be found in the vagina or rectum. It may be called a symptom rather than a separate disease, as more than half of the cases are located upon the mucous membrane of syphilitics, although the disease itself is not a syphilitic manifestation.

Its etiology in many cases is not discernible. Its essential etiological factor is not known. The average age of these patients is between 40 and 50 years, although I have seen it in the early twenties. The disease has a predilection for males.

Its pathology consists of thickened semi-cicatricial patches of mucous membrane, which, if studied under a magnifying glass, will be found to be covered with small ulcers. At later stages there may be deep ulcerations. There is pain when the surface comes in contact with any irritating substances, as acids, strong alkalies, or spices.

The cardinal symptom is, of course, the bluish-white patch upon the mucous membrane. It is usually accompanied by a slight pain upon irritation. There is no difficulty in diagnosing this disease as no other simulates it closely. Its importance lies in that it is an etiological factor or pre-cancer lesion in many cases of mouth and tongue carcinoma and for this reason should be treated as soon as seen.

Surgery and drugs have but little effect upon it unless its etiology is syphilis, then, of course, anti-syphilitic treatment is the best for the preliminary treatment which should be followed by radium, as radium is the best treatment for all cases regardless of the etiological factor. Fifty milligram packs of radium screened with $\frac{1}{2}$ millimeter of brass and lead, and 1 millimeter of rubber should be kept in contact with the area for one-half to two hours, depending upon the severity of the lesion. If the lesion is too large for a single pack, it should be shifted at the end of each period until the entire area is covered. This treatment should be repeated at monthly intervals until the lesion disappears. Many times a

single application of radium is all that is required. After that it is merely a matter of observing the case to be sure that the lesion regresses to obliteration.

Prophylaxis consists in removing all unnecessary irritations, as tobacco, spices, bad dentition, or bad dentistry. Desiccation is to be thought of if radium is not available, but is of secondary value to it.

The average length of time required for the treatment of these cases is from one to three months.

The prognosis of the disease itself is always favorable, although when it becomes malignant it must be classed with the malignancies, and if allowed to proceed to any depth in the tissues the prognosis will necessarily be bad.

Case No. 15. Male, age 38. Referred to us July 23, 1924, at which time we advised radium. He had first noticed the lesion two years previous when it was a white spot in the buccal cavity at the left angle of the mouth. Fifteen years ago he had lues. The lesion was aggravated by his work, auctioneering.

On August 8, 1924, we applied 25 milligrams of radium between the lips and 50 milligrams in the buccal cavity for one and one-half hours. The screening was 1 mm. of rubber and $\frac{1}{2}$ mm. of brass. On August 27th, there being a little radium dermatitis, we gave him one minute from the water-cooled lamp. On September 3rd, 12th and October 1st he had treatments of one minute each with the water-cooled lamp.

The one treatment of radium was all that was needed, as he reported himself well November, 1925.

DIAGNOSIS: Leucoplakia.

Lichen Simplex and Planus.

Lichen simplex is an inflammatory disease characterized by small, flat, shiny papules, which are red or reddish purple in color. The two principal types of the disease are lichen simplex and lichen planus.

Lichen simplex and planus differ from each other principally in the extent of the involved area as to width, depth, and intensity of color. The simplex is more superficial and accompanied by more itching; it covers a larger area and is more of a pink than red or purple in color and is more closely allied to eczema. Lichen planus tends to involve larger areas about the flexures of the arms and legs, to greater cornification, more edema, and has a deep red or purple color.

The treatment of both conditions is the same, except that the lichen planus tends to yield more readily than the simplex.

The pathology is in the corium particularly in the connective tissue cells and spaces.

It has no characteristic blood picture.

The cardinal symptom is shiny papules formed in the corium which tend to coalesce, forming patches of varying sizes, which are usually found in flexures, particularly of the arm and leg, although they may be upon any portion of the body. Pruritis always accompanies and is, at times, unbearable.

Diagnosis. Only two other diseases are to be thought of which are pityriasis rubra, and eczema. In the pityriasis rubra, the papules are more pointed at the top, forming a cornification, while eczema is usually more discrete and weeping. Eczema also has intense itching, while the lichen case may have very little itching.

The general management of these cases requires a careful hygiene, a limited amount of outdoor exercise, and a diet composed largely of fruit and vegetables, as there is usually a digestive disturbance. The bowels should be kept free, but not loose.

As for treatment, drugs are useful for the constitutional and digestive disturbances. Strychnia arsenate, 1/100 of a grain three times a day, is one of the best. Locally drugs have but little effect upon the disease. A 20 per cent sulphur ointment is valuable for the itching.

In physiotherapy, the general visible-light and actinic-ray treatments, with extra actinic rays from the water-cooled lamp over the lesion itself are the most useful. Occasionally a stimulative dose of X-ray is of value.

There are no complications and the disease is neither contagious nor infectious.

The average length of time it will require treatment will be from a few weeks to a few months.

The prognosis is good and recurrence is rare.

Lumbago.

Lumbago is a myalgia which always starts as an acute condition but may become chronic if allowed to go untreated or improperly treated. It is a pure myalgia and the same condition may affect other muscles of the body, although at the present time we are studying only a myalgia of the lumbar muscles.

It has for its etiology not a bacteriology, not an infection, but a sudden muscle fiber contraction which locks in the fatigue toxins, thus irritating the terminal nerve filaments and producing pain.

The pathology is simple, being a contraction of contiguous bundles of muscle fibers.

Its one cardinal symptom is pain and the consequent interference of motion. The usual symptoms accompanying it are inability to move the body to certain positions because of the pain in the individual muscles; usually it is unilateral, although it may be bilateral.

In diagnosis it must be differentiated from pleurisy, spondylitis (Pott's disease), a sacro-iliac relaxation or inflammation,

psoas abscess, perinephritic or renal colic, neuritis, acute nephritis, arthritis, injuries, intercostal neuralgia, pleurodynia, and acute abdominal and pelvic conditions associated with pain.

The general management of these cases is good hygiene, a limited or controlled exercise, and free bowel movements. Rest is usually indicated by the pain but does not influence the progress of the disease. Surgical treatment is not needed. Drugs are rarely useful.

Physiotherapy usually furnishes a complete treatment for these conditions and is best given as visible light for a period of thirty minutes to one hour over the affected part at a distance comfortable to the individual, which is followed by vibration or massage of the affected muscles. Vibration should be continued for about five minutes or massage until there is relief of pain. This should give immediate relief and from one to five daily treatments should give complete relief in acute cases.

Chronic lumbar myalgia should not be confused with chronic articular rheumatism, or sciatica, or myositis ossificans.

The principal complications of chronic lumbagos are myalgia in any other portion of the body; a chronic fibrositis whose pathology consists of inflammation due to the irritations or traumas within the muscle fibers which, if not immediately relieved, go on to fibrous tissue formation and this is the condition which is usually called chronic lumbago.

These chronic fibrocytes producing myalgia have as etiological factors: extremes of temperature, especially when wet, local injuries either by direct contusion or severe strain of tendons or muscles, toxin absorption from tonsillar infections, bad teeth, influenza bacillus, etc.

Its characteristic symptoms are pain and fibrous bands or nodules within the muscles. These can readily be found by palpation. If untreated or improperly treated, these fibrous bands continue to increase in size, thus limiting the motion of the affected part.

The cardinal symptoms in all of the chronic myalgias are pain and loss of function. They are usually found in the muscles of the neck, shoulders, upper arms, intercostal muscles, lumbar muscles, and about the hands, the most severe cases being the Dupuytren contractions of the palmar fascias and about the finger joints. They are in no way related to the rheumatoid arthritides or arthritis deformans. However they are directly related to chronic synovitis. Fibrositis occurs principally about the knees and has as its characteristic symptom a crepitation or creaking on movement which is accompanied by pain or tenderness. This has been described by Taylor as plastic adhesions which appears to us to be the best description extant and which gives us an idea as to the proper treatment required for their relief. The general

health must be kept in the best possible condition. Exercise is limited to the amount that can be taken without pain. Rest is not necessary except to limit the action of the muscles. The diet should be non-stimulating or purely a vegetable and fruit diet, unless there is an intestinal intoxication, when it is best to prescribe a fast for a few days followed by a pure milk diet. The bowels in all cases must be kept free.

Surgical treatment except in the very late stages is not necessary, and then only to free badly contracted areas.

Drugs in any form are of little value and only for the relief of pain, unless the disease is due to an infection, which is rare. In these cases intravenous injections of sodium iodide, 32 grains, and guaiacol, $\frac{3}{4}$ of a grain, are of value. Thiosinamin and fibrolysin have been used by the writer with questionable results. In the severe cases, they may be worthy of a trial. Injections are given into or near the fibrous tissue with an aseptic hypodermic syringe.

The physiotherapeutic treatment of these cases is usually ideal if the case is seen before the contractions are extreme and the deformity great and the fixation osseous. If it is possible, these cases should first be put into an electric light bath cabinet and the treatment continued to the point of fatigue. This gives the best elimination that it is possible to obtain in the shortest period of time and with it complete muscular relaxation. While still in the cabinet, give a general actinic-ray treatment of one minute which should be increased each treatment about one minute until a period of seven to ten minutes is reached and then continued at that period.

This should be followed by massage of the affected parts, together with the surrounding tissues. Vibration can be used to shorten the treatment but is not equal to manual massage. These treatments must be continued daily until there is decided improvement, then three times a week, and should be continued until function is as completely restored as possible and until there is complete relief of pain. This massage is best given with an olive oil lubricant.

Diathermy may be used in some of these cases with very satisfactory results, but is usually limited to cases having but few areas of involvement. The composition-metal electrodes should be thin enough (36 to 40 B&S gauge) to mold well over the part and of sufficient size to cover it. They should be molded and held by pillows and sand bags. The indifferent pole should be as nearly opposite as it is possible to have it and should be considerably larger than the active electrode, for in these cases it is surface heat that is desired. This treatment should be given daily at first, later at longer intervals, for not less than thirty minutes, using as much current as the patient can comfortably bear, *no more*.

The average length of time these cases will require treatment will depend upon the length of time the disability has continued before treatment was begun and the amount of contraction and fibrosis. Usually these cases will improve in the first few treatments and should be free from pain in from one to three months, although one must not expect to remove all disabilities and deformities.

The prognosis as far as life is concerned is always good.

Case No. 525. Male, age 52. Came to me March 4, 1925, complaining of pain in the lumbar region, which was of two weeks' duration despite the fact that he had daily general visible light, actinic rays, and vibration over the lumbar region.

After examining the case our diagnosis was a simple lumbago and that the only reason the previous treatment had been ineffective was the fact that the individual treatments had not been of sufficient length nor of proper intensity.

Our first treatment was visible light for sixty minutes, vibration for five minutes. This gave immediate relief and he reported the next day that he had no pain symptoms of any kind. He was given thirty minutes of visible light and five minutes of vibration and discharged. The two treatments were sufficient to remove the pain of two weeks' duration.

DIAGNOSIS: Lumbago.

Lupus.

Lupus cases all fall into two main groups—*lupus vulgaris* and *lupus erythematosus*. Many qualifying words are used in connection with the word *lupus*, but are finally separated into the two types already given.

The etiological factor in both cases is probably the tubercular bacillus. MacLeod (London) thinks tuberculosis as a complete cause is not sufficient, but that something of a toxic or septic nature is at least a predisposing cause, together with delicacy of the skin and a weak peripheral circulation. An enfeebled state of health may have something to add to the etiology. In the cases of *erythematosus* it usually occurs in those who have feeble integumental circulation and integuments underlaid with very little fat. If these people are subjected to the extremes of heat and cold, they are more likely to become affected.

Lupus vulgaris starts as a reddish brown papule, radiating equally until the area involved is an inch or more in diameter. It usually heals on one margin and spreads at the opposite one. The spreading margin has a rolled, thickened edge which is not undermined. This is the cardinal symptom of this disease and with it alone the disease may be diagnosed.

The pathology of *lupus vulgaris* is the ulceration which may spread into the subcutaneous tissues or even into the underlying

muscles or bones. There may be various patches in various portions of the body which start at or about the same time. It is neither contagious or infectious but may be auto-inoculable.

The diagnosis will depend upon the character of the lesion already given and the disease must be differentiated from all other ulcerating surfaces.

Lupus erythematosus is differentiated from lupus vulgaris by the character of the lesions which are superficial—there is less of a rolled edge as the lesion advances and the surface is covered with branny scales.

The usual location of lupus erythematosus is about the face, neck or chest, while lupus vulgaris is more frequently found upon the chest and extremities. Both lesions are extremely chronic, maintaining steady growth up to twenty or more years.

The general management is strictly hygienic.

The treatment of lupus—either erythematosus or vulgaris—is mainly by actinic rays. If the area is small, it may be treated with the water-cooled lamp, but if large, with the air-cooled lamp. In conjunction with these measures it is, at times, necessary to destroy the rolled edge which is the spreading margin of the disease by trichloroacetic acid (50% solution) or by the use of the Oudin or d'Arsonval currents. The Oudin current is usually preferable, as the destruction by it is superficial and this is all that is needed to stop the spread of the disease, after which the actinic rays will be all sufficient.

The treatment with these rays from the water-cooled lamp should be about one minute at a distance of one inch to start with, and treatments should be repeated about three times a week, gradually increasing the time until blistering is produced. After the wound begins to heal, twice a week will be sufficient. If the air-cooled lamp is used, it should be at a distance of eight or ten inches for three to ten minutes. The frequency should be the same as with the water-cooled lamp.

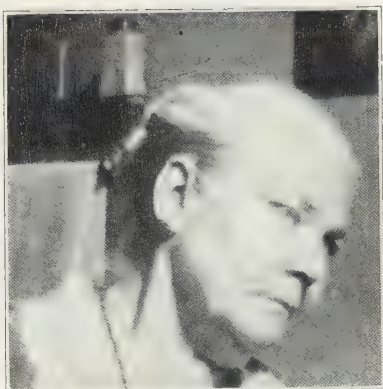
Drugs used internally have no effect upon the progress of a case of lupus.

The average length of time required for the healing of a case of lupus will vary with its chronicity and the size of the area involved. However, it will usually take from one to six months and in very severe cases a year for complete healing. These patients should be given the best hygienic treatment possible, plenty of fresh air and sunshine and a well regulated diet, for they are manifestly tubercular.

Case No. 65B. Male, age 45. Came to us November 21, 1920. He had noticed a thickening of the skin about six months previous and these spots had broken down three months later. They were spreading rapidly. Four open areas about 5x10 cm., 4x4 cm., 2x3 cm. and 2x2 cm. in size were observed.



Lupus vulgaris.



Three months later.



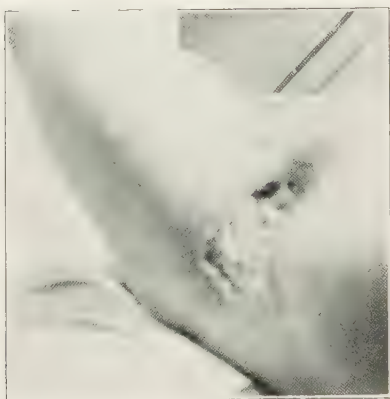
Lupus vulgaris on hand and arm.



Lupus vulgaris on foot.



Lupus vulgaris on chest and neck.



Lupus vulgaris in axilla.



Lupus vulgaris with extensive
osteomyelitis.



Three weeks later. See
case report.



Lues of humerus.



After three weeks' treatment.
Differentiating lues and osteomyelitis.

We gave him visible light for five minutes with two minutes of actinic rays; on November 23rd, ten minutes of visible light and two minutes of actinic rays; on the 26th ten minutes of visible light and five minutes of actinic rays. Some of the pustules were healing rapidly, others more slowly. He had 49 treatments in addition to the above, each ranging from five to ten minutes of actinic rays and at this time all open places were closed.

DIAGNOSIS: Lupus Vulgaris.

Lymphangitis and Lymphadenitis.

Lymphangitis and *lymphadenitis* are so closely associated that they will be considered together. They may be acute or chronic.

Their etiology is either bacterial or toxic.

Their pathology is inflammation of the lymph vessels and receiving glands. There are two main types of lymphangitis—the capillary, of which erysipelas is a type, and the tubular or larger lymph vessels. This type manifests itself when there is infection of the hands or feet as broad red bands running from the infected area to the lymph glands in the axilla or groin. As a rule, the lymph vessels are not inflamed unless the bacteria are of a particularly virulent type or the toxic material is in very large quantities.

The laboratory findings are the etiological bacteria which may be found in the blood stream as well as in the lymph vessels, but particularly in the infected area.

The cardinal symptom is inflammation of the vessels, which produces a redness of the surface both in and around the lymph vessels involved. This red streak will usually start at some point of infection in any portion of the body. The symptoms usually occur in the following order: chill, fever, nausea or vomiting, with loss of appetite. If there is considerable lymph involvement, there may be an accompanying edema due to the obstructed flow. As the infection is carried to the lymph glands these in turn are infected, become swollen, painful, red, and if unable to destroy the infection, are themselves in turn destroyed.

The diagnosis is usually based upon the red streaks starting from a point of infection and ending in a group of lymph glands. However, it must be differentiated from an ordinary edema, erythema, or dermatitis, also from phlebitis, which, while producing redness produces an enlargement of the vein and is usually limited to one region and separated from groups of lymph glands by areas which are not involved.

In the general management of these cases, exercise should be restricted or prohibited during the period of inflammation. Rest, with the elevation of the limb, is often absolutely necessary. The diet should be light, or better still, a fasting period of a few days should be advised. The bowels should be kept loose, even watery, for the first few days.

The surgical treatment is free opening of the suppurating lymphatic area and drainage of the suppurating glands. Internal medication does little except as a supportive treatment. Bacterines have not proved particularly useful. Intravenous medication of sodium iodide, 32 grains, and guaiacol $\frac{3}{4}$ of a grain, is of distinct value in these cases and should be used at the earliest moment. Antiseptics used locally over the inflamed area have been a time honored treatment, but physiotherapy offers something far in advance of any wet dressing.

Visible light is of distinct value in relieving the edema and blood and lymph stasis. Actinic rays are the only treatment needed for most cases and are sufficiently penetrating to destroy the infection in the superficial lymph vessels as well as a goodly portion of the infection at the site of origin and in the involved lymph glands and is by far the treatment of choice.

Actinic-ray treatments for lymphangitis should be given with the water-cooled lamp at a distance of about one-half inch for a period not exceeding ten or fifteen seconds for each area treated. The best method is to keep the lamp very slowly but constantly moving along the line of infection, with a few seconds extra when reaching the lymph gland area. In addition to the local actinic-ray treatments for the control of the local infection, general visible-light and actinic-ray treatments are of distinct value in building up the individual's resistance and thus aid in immunizing the case. These general treatments should always be used for the complicating features of the case.

Complications are acute infections along the involved lymph vessels, acute joint infections are frequent, the heart or its membranes may be attacked early, pleura and lungs have frequent foci of infections by metastasis through both lymph and blood stream, and bacteria may be carried into the bones producing an osteomyelitis. Meningeal complications are common and are to be looked for in every case. If the case is seen early and if actinic rays are used freely, complications are rare.

The average length of time these cases require treatment will depend largely upon the stage at which the case is first seen. If seen within the first twenty-four or forty-eight hours, the case should be practically well within a week's time as far as the lymphatics are concerned, but if the infection has spread deeply and the lymph glands have been destroyed, they may require treatment for several weeks.

Barring complications the prognosis is good.

Lymphadenitis.

The chronic type of lymphadenitis is usually tubercular, giving much the same symptoms, although slow in action and less likely to have complications or metastasis to other portions of the

body. If metastasis does occur, it is usually with the next chain of lymph vessels and glands.

Tubercular lymphadenitis spreads wholly through the lymph vessels. If pus forms in the lymph glands it should be evacuated by simple incision without irrigation or drug application of any kind. All that is needed in the majority of cases is the application of actinic rays from the water-cooled lamp, at a distance of one inch, over the gland and surrounding tissues for one to three minutes daily to three times a week. In addition to this, general visible-light and actinic-ray treatments should be given and sodium iodide, 32 grains, and guaiacol, $\frac{3}{4}$ of a grain, given intravenously for adult cases. Under this treatment tubercular fistulae should close in a few days or a few weeks at most, and the glands should undergo reduction in the course of a few weeks or at most a few months.

Occasionally tubercular glands which are deeply located will need something more penetrating than the actinic rays from the quartz mercury-vapor lamps and for these cases we advise the gamma rays of radium or X-ray. For the X-ray about one-fourth to one-half of an erythema dose, while with radium we would advise packs of 50 milligrams screened with 2 cm. of leather, 1 mm. of lead, $\frac{1}{2}$ mm. of brass and 2 mm. of rubber. These should be left for two to six hours and results from this treatment should be seen within a week or ten days. These are to be followed by the actinic-ray treatments as given above.

Of useful drugs, iodine and calcium head the list. While each practitioner has his own favorite preparation of iodine and calcium, the one we like best is the iodide of lime, which combines both in one remedy. Of this about one grain two or three times a day is sufficient. If it is desired to use arsenic in these cases, a good preparation is calcium cacodylate in doses of one grain intravenously, daily to twice weekly.

The treatments should be continued for some time after the glands are apparently normal.

Magnesium Sulphate.

Magnesium sulphate is so old and so well known that it seems nothing new can be added to our knowledge of its use. However, there are several uses, not new, but unknown to the majority of the medical profession, so I deem it advisable to add a short chapter covering its clinical use for a period of twenty-five years.

When used as an active cathartic, the usual dose is from a half-ounce to an ounce given in a saturated solution or nearly so. It works when thus given, but is drastic to say the least, and just as good (in my judgment better) an action can be obtained if a dram in a half-glass of water is given hourly until the desired effect has been produced. Four to six hours are usually sufficient

for free catharsis. If time is a factor, it may be given intravenously in a 10% solution, 20 c.c. being given as a dose.

It can also be given intramuscularly and is frequently so given for its analgesic effect, which enhances the action of morphin sulphate materially. The morphin may be dissolved in the magnesium solution.

Locally it is the best all around wet dressing with which we are familiar. It is not classed as an antiseptic nor as a bactericide, but it has bactericidal powers, even though they are indirect. When used as a wet dressing, we employ it in a solution of one ounce to a pint of water. When thus prepared it can be used for sprains, bruises, or contusions, or it may be used on open wounds. When so used no harm can come from its use and it usually allays pain and inflammations unequaled by any of the recognized antiseptics. This may be due to its anesthetic action.

The same strength (1 to 16) is used (not when death seems imminent and as a last resort) as a wet pack in cases of bronchitis and pneumonia (all forms and types). When I say wet pack I mean soaking wet, not occasionally but continuously night and day.

In the bronchitis cases, usually a wet pack over the anterior surface of the thorax is sufficient, but for the pneumonias use a heavy cotton pneumonia jacket and keep it soaked. When the temperature is 102° F. or higher, keep ice in the solution to keep it cold. After the temperature has reached 100° F, stop the ice and use it at room temperature until the temperature reaches 99° F., then use it at room temperature but keep hot water bags at the sides to maintain body heat. Continue the pack for at least 24 hours after the temperature reaches normal, and many times it is better if it is continued for 72 hours longer.

Relief of dyspnea will occur in less than one hour after the pack is applied, and as a rule the temperature will fall within twenty-four hours, many times in twelve hours. Every hour or oftener sponge the whole body with this same solution (1 to 16) and let it dry on. The patient will be grateful for the effort.

This same, ice-cold wet pack can be used to advantage as a relief in cases of acute pharyngitis, laryngitis, or tonsillitis. Meanwhile use a solution of one dram to eight ounces of water as a gargle, and after gargling have the patient swallow a dram or two of the solution for its effect on the tissues further down the esophagus and what goes into the stomach will do no harm.

In typhoid or other fevers, use a (1 to 16) solution for sponge bathing as often as the patient wishes, several times a day will do no harm. It will not cure the fever, but it reduces it and makes the patient comfortable.

For carbolic acid poisoning, use it both locally and internally. It is one of the best antidotes.

In erysipelas use it as a saturated solution for a wet com-

press. It will stop some cases and retard others. It is worth trying.

The same may be said of its use in arthritis, but here use the 1 to 16 solution, for the saturated solution used continuously on the skin produces an eruption similar to iodism and the blisters are slow in healing.

In pelvic inflammations use a solution of the following: magnesium sulphate saturated solution, 25%, glycerin 75%. Put two to four drams in the vagina followed by a tampon to keep it there. Remove the tampon in six hours and follow with a magnesium sulphate douche (1 to 16); repeat as often as desired, also as long.

If used in the rectum, use as a retention enema; dose, one ounce of the glycerin mixture.

After you have used the normal saline proctoclysis to the extent needed, switch the sodium chloride to magnesium sulphate, using the same quantity, and soon you will have the cathartic effect without oral administration.

Where there is nausea and vomiting it is sometimes advisable to use magnesium sulphate by proctoclysis.

In eclampsia, even in desperate cases, use an intravenous injection of magnesium sulphate (C.P.) 10% solution in doses of twenty c.c. repeated as needed after four or more hours.

Myositis.

Myositis is an inflammation of muscles usually confined to the extremities.

Etiology. It is usually secondary to infective processes in other parts of the body, although rarely it is apparently primary. The infecting organisms are the common ones which produce inflammation and suppuration.

Types. There are several types from non-suppurative through suppuration stages to fibrosis and calcification. The latter is described as myositis ossificans, which is a progressive ossification of muscles following the primary inflammation and may ultimately affect most of the muscles of the body.

The pathology is given under the heading of types.

The blood picture is that of an acute or chronic infection with a leucocytosis.

Differentiation. Myositis must be differentiated from osteitis and periosteitis by the use of the X-ray. There is no normal bone involvement with myositis although calcification of muscles may take place. This can also be diagnosed by roentgenograms although special technique is needed to separate the newly ossified areas from the normal bones. Trichinosis, arthritis, syphilis, and tabes dorsalis must be ruled out. Muscular rheumatism and the neuralgias require a careful examination to differentiate.

The cardinal symptoms are sudden onset of localized pain in a muscle or set of muscles associated with induration, heat, swelling,

redness, and tenderness on palpation. Should pus develop, there will be edema followed by fluctuation. Chills and fever accompany most cases and vary in severity with the amount of infection and its virulence. The non-suppurative type is of much lower virulence and tends to become classic. The fibrosing and ossifying types produce permanent changes.

Treatment. The general management of these cases will require rest for the advanced case and physiotherapy for all of them. Surgery is indicated for the removal of pus and calcifications but should be followed by some form of physiotherapy, mostly visible light and diathermy. Actinic rays are contraindicated in the fibrosing and ossifying types but are indicated in the suppurative cases. Infra-red frequencies are of value for prolonged radiation using a mild heat. Visible light should be used for one or more hours over the involved area and surrounding tissues and general body treatments would be advantageous.

Diathermy should be given through the involved area using a mild heat, probably not to exceed fifty milliamperes per square inch of the smallest electrode. The frequency of these treatments should be daily at first, then three times a week. The average length of time these cases will require treatment is from a few weeks to months. The progressive ossifying cases are probably incurable by any means, although considerable relief can be given.

Prognosis is fair except for the ossifying cases.

Nasal Tumor.

Tumors of the nasal cavity in the order of their frequency may be classed as mucous or fibrous polypi which may be single but are usually multiple; papillomata, which occur at the muco-cutaneous margin; sarcomas many of which occur in the ethmoid or antrum of Highmore; carcinomas (which are usually of the adeno-carcinoma type) are developed in the antrum and spread into the nares; enchondromas which usually spring from the septum; fibromas and adenomas or combinations of both, and exostoses.

The diagnosis of each of these conditions is usually by the aid of the microscope, although some of them can be diagnosed clinically. The mucous polypi usually spring from the middle turbinate and are pedicled, freely movable, soft baggy masses, many of them so nearly transparent that diagnosis should not be difficult by the aid of a reflected light.

Adenomas, fibromas, sarcomas, and carcinomas are almost impossible to differentiate without the aid of the microscope, except in the late stages when any method of treatment is of little avail.

In the main, it may be said that the fibromas are the least likely to become necrotic and the carcinomas the most likely, with the sarcomas midway between.

In the treatment of all of these conditions physiotherapy offers much. Use the d'Arsonval current for the destruction of the growth

and in the malignant cases follow this by applications of radium in suitable containers and suitably placed to destroy all malignant cells which could not be reached by electrocoagulation. As most of the malignant cases are seen late, the prognosis is usually bad although life may be prolonged and the patient be made more comfortable by the use of the measures already given.

Simple adenomas and fibromas can be destroyed by electrocoagulation with very little chance of recurrence.

The only tumor of the nasal cavity which should not be destroyed by electrocoagulation is the exostoses, and while these could be destroyed by electrocoagulation, there is so much danger of perforation of the septum it is best to remove them surgically.

The benign nasal tumors should be destroyed in one treatment and should be healed in from three to six weeks. The malignant growths will require attention for months and if recurrent, as long as the patient lives. The malignant cases which are apparently well should be followed closely for evidence of recurrence for a period of many months, after this at lengthening periods for years.

Case No. 18 A. Female, aged 40. Came for treatment July 29, 1918. Complained of inability to breath through the right nostril. Inspection revealed a rough mass which filled the anterior portion of the nostril. There was no tendency toward bleeding or ulceration. Some discomfort but no pain. The mass had been slowly but persistently growing for the past two years.

A specimen was removed for laboratory examination and this was pronounced fibro-sarcoma by Dr. L. Hektoen.

The treatment was removal by electrocoagulation through the nostril. There has been no recurrence to date, June, 1926.

DIAGNOSIS: Fibro-sarcoma.

Nephritis, Acute Parenchymatous.

Nephritis occurs in two main types, acute and chronic. These are subdivided according to existing pathology.

The most common of the acute types is the acute parenchymatous nephritis, which occurs most frequently in children but may occur at any age. It is a complicating factor in most of the infectious diseases particularly of the eruptive fevers and occurs most frequently after scarlet fever. It frequently occurs during pregnancy. In the adult, exposure to cold and wet weather without adequate protection is a frequent etiological factor. Other factors are extensive burns and acute inflammatory diseases. Chemical toxicities are very common etiological factors and the most frequent among these are turpentine, cantharides, carbolic acid, arsenic and various forms of mercury and lead.

Any bacteriology present may be an etiological factor. Post-tonsillar or streptococcic infection of the kidney is fairly common. In a few instances the infection spreads upward from the bladder

through the ureters into the pelvis of the kidney. The acute nephritis is then secondary to the local infection and has the same bacteriology as its etiological factor.

While the pathology of acute parenchymatous nephritis is complex, it may be summed up in a few words as an inflammation of the parenchyma or secreting structures of the kidney. This naturally includes the glomerular tufts, loops of Henle and tubules.

Acute nephritis must be differentiated from retention of urine, cystitis, with or without hematuria, edema due to various diseases—particularly venous thrombosis and cardiac disease, pyelitis, nephrolithiasis and chronic nephritis.

The cardinal symptom of an acute nephritis is a sudden onset of edema, which may be local about the eyes or a general anasarca. The usual symptoms coming on later in the course of an acute inflammatory disease are chilliness, nausea and possibly vomiting, and pain which is usually referred to the back. Convulsions are of common occurrence in children. If the inflammation is of sufficient intensity to involve practically the whole kidney at one time, uremia is of rapid onset and usually fatal.

The urinalysis will usually clear up the diagnosis of acute nephritis. In these cases the urine will be scanty and in very severe cases with uremia there may be a complete anuria. However, there will usually be one, two, or three hundred c.c. of urine secreted in twenty-four hours. Toxic cases are most likely to have a complete suppression. The specific gravity is somewhat high, usually around 1.025 to 1.030, and with this concentration the color will be much darker than normal.

If the nephritis is due to chemical agents, there will undoubtedly be blood in the urine which may give it either a red appearance if of alkaline reaction, or a reddish brown or black if the urine is of acid reaction. There will be albumin and casts which are mainly hyalin, granular, blood, and epithelium. Usually the albumin will be less than one per cent. With the general anasarca there may occur a hydrothorax, hydropericardium, or ascites, which conditions will give rise to a severe, if not fatal, dyspnea.

While the diagnosis is usually comparatively easy from the history of the case, the symptomatology, and the urinary findings, yet these cases must be differentiated from local edema of phlebites, obstructed portal circulation from any cause, toxic symptoms without nephritis and an acute infection of any portion of the body. Remember that the main etiology of acute nephritis in adults is acute infectious or inflammatory disorders. In children acute nephritis usually follows eruptive fevers, particularly scarlet fever.

The general management of these cases consists of the best hygiene possible, absolute rest in bed is one of first importance and the bed should be covered with warm blankets to maintain

body temperature and to cause free perspiration, thus temporarily relieving the kidney as much as possible. The bowels should be kept open with saline cathartics for the same reason. Milk is the best food until after the acute symptoms have passed. It may be whole, pasteurized, or skimmed milk, or buttermilk and the diet should be absolutely salt free. Pure water or hot lemonade should be taken in as large quantities as the stomach will care for, which in turn should be eliminated by skin and bowels until the kidneys are again active.

Surgical treatment of these cases is not required except for pyonephritis or where there is a very severe superficial edema, which may be reduced by making many small punctures in the skin of the lower extremities, thus allowing large quantities of serum to exude, giving temporary relief.

If there is nausea and vomiting, drugs by mouth should not be used. Should ordinary measures fail and uremia threaten, pilocarpine in doses of $1/10$ to $1/6$ of a grain hypodermatically will be found of value but must be used with extreme care if the heart is involved. Occasionally heart stimulants will be needed and digitalis is one of the best. Convallaria, strophanthus, and spartine are at times of value. As diuretics, the potassium salts, either acetate or citrate, may be given in doses of 10 to 30 grains three times a day. For the infective cases, drugs intravenously, as sodium iodide in doses of from 5 to 15 grains every twelve hours, will be found beneficial.

Physiotherapy offers much for these cases both for immediate relief of symptoms and for the recovery of the patient. This is best accomplished by the use of either visible light and heat, or electric heaters, followed by packing in dry hot blankets to keep up the perspiration. The visible-light baths have a decided advantage over the dark heat, wet packs, or hot baths because they give quicker relief and the added constructive action of the light rays. They must be given cautiously so the patient is not weakened too much, and must be followed by plenty of hot blankets to prevent sudden chilling. These light baths may be given several times a day, according to the necessities of the individual case. If possible these should be followed after twenty-four or forty-eight hours by the use of actinic rays from the air-cooled lamp. Following these sweating periods, the condition of the patient may be very much improved by the use of epsom salts baths of a concentration of one ounce to one pint of water. This is permitted to dry on.

Acute nephritis is a complicating disease. Its complications will be those of the etiological factor.

The average length of time that these cases require treatment will be from a few days to a few weeks. If it progresses beyond this time, the case then becomes a chronic nephritis, which may

extend over a period of years and for this reason these cases should be watched carefully and, if at all possible, restore the kidneys to perfect function before treatment is discontinued.

The prognosis in all cases of acute nephritis will depend entirely upon the etiological factors, the early stage at which the case is seen for treatment, and the thoroughness with which this treatment can be carried out. Nephritis from large doses of chemicals is usually hopeless because the parenchyma is actually destroyed, and if the chemical is not antidoted in less than forty-eight hours it may be considered fatal. Cases occurring in the path of an acute inflammatory or infective disease are favorable provided proper treatment can be inaugurated early.

Nephritis, Chronic.

Chronic nephritis is usually found in two main types: first inflammation and degeneration of the parenchyma, and second with inflammation of the kidney substance and subsequent formation of fibrous or connective tissue. Other types are but varying stages of the parenchymatous or interstitial types.

The etiology of chronic nephritis is frequently an acute nephritis from which the individual has not completely recovered, but many cases start insidiously either the result of some low grade infection which persists for an indefinite length of time or it may follow some of the chronic constitutional disorders as tuberculosis, syphilis, etc. There is usually an amyloid degeneration late in the case. Slow poisoning from a chemical agent as the ordinary lead or an arsenic poisoning can also be productive of a chronic nephritis.

The pathology of the chronically inflamed kidney is first an infection or toxic irritation of the renal epithelium. This may change to the large white kidney and may later become the small white or classic contracted kidney the end result of cicatricial contraction. These changes may occur spontaneously throughout the entire organ or in localized areas. Other areas may be normal or inflamed.

There is no definite blood picture although the advanced cases are usually accompanied by a secondary anemia.

The urinalysis will show an increase in albumin, in quantities, varying from one or two up to ten per cent, usually from one to four per cent. The quantity of the urine will vary with the amount of kidney involvement, which may be anywhere from an anuria to a polyuria.

The microscope will show tube casts usually of the hyalin, blood, waxy or epithelial types, and if there is much active inflammation, granular casts will be found in abundance. Casts are most abundant in the parenchymatous variety and tend to disappear as the interstitial change takes place. Chronic nephritis must be dif-

ferentiated from albuminuria, not due to nephritis, primary anemias, leukemias, cardiac diseases, pyelitis, subphrenic abscess, perinephritic abscess, nephrolithiasis and hypernephroma.

There is scarcely a symptom in chronic nephritis that can be called cardinal. The usual symptoms are loss of appetite with indigestion, slight dyspnea particularly on exertion, headache, pallor and impairment of general health and strength. These, however, do not usually make their appearance in the chronic cases for a year or more after the disease becomes active. High blood pressure (200 or over mm. of Hg.) is usually a late symptom. Puffing or edema may occur first in the pretibial region or about the eyelids and feet, gradually extending over the body as the disease progresses and the function of the kidney becomes impaired. Progressive edema and diminished quantity of urine both indicate progressive destruction of the secreting structures of the kidney. Casts increase until there is definite interstitial changes when they begin to diminish in numbers and variety. The late edema is most marked in the most dependent portions of the body. As the disease progresses, dyspnea becomes a prominent symptom and it may occur either from toxicity or as a pressure symptom and is most marked when the patient is lying down, hence in advanced cases these patients are compelled to sit up so that they may diminish the cardiac and respiratory pressure. Fatalities may occur if these advanced cases are permitted to lie down. Uremic symptoms are vertigo, frequently diarrheas, delirium, stupor or coma becoming progressively worse as the destruction of the parenchyma advances.

The chronic nephritic cases are subject to remissions which may last for weeks or even months. Cases which progress steadily or those which are untreated usually end fatally within a few months or at most two or three years of time.

Treatment. Given the same pathology and the same symptomatology only in greater degree, the chronic parenchymatous nephritis is treated very much the same as the acute parenchymatous nephritis. Many of the chronic cases are not preceded by acute diseases or symptoms and are usually detected first by an examination of the urine.

Nephritis, Chronic Parenchymatous.

Diagnosis must be made on the laboratory findings, the general condition of the patient, and any clinical manifestation of complications. Any improvement will be manifest by the diminishing amount of albumin and the return toward normal of solids excreted with the diminution or disappearance of casts.

Acute parenchymatous nephritis has diminished amount of urine, a specific gravity of 1.025 to 1.030, albumin around 1%, hyalin, epithelial, blood and granular casts with both red and white

blood cells. It usually follows acute infectious diseases, sudden severe chilling or acute poisoning. Blood pressure is nearly normal.

Chronic parenchymatous nephritis has a normal (or nearly so) amount of urine, specific gravity 1.020 to 1.025, albumin 1 to 8%, casts of all kinds which are abundant, many blood cells, and usually follows acute attacks of nephritis or constitutional diseases. Blood pressure systolic up to 180 mm. of Hg.

Chronic interstitial nephritis has a greatly increased amount of urine up to 5000 cc. in twenty-four hours, specific gravity 1.005 to 1.010 and a trace of albumin. Casts are few in number and these are hyalin or fine granular. A few red blood cells are found in the urine but are usually due to senility. Chronic interstitial nephritis is a late stage of chronic parenchymatous nephritis, slow chemical poisoning, or arteriosclerosis. Blood pressure is greatly increased, the systolic ranging from 180 to 300 mm. of Hg. A marked decrease in nitrogenous compounds indicates a bad prognosis. These may be temporarily increased by actinic-ray treatments.

The general management of these cases will consist of the best hygiene possible, limited exercise (although exercise is extremely valuable when the heart is not damaged and the edema is not great), rest in bed is essential if these two factors are very manifest, a rigid diet particularly of milk in the advanced stages, or of milk, vegetables and fruit in the more chronic and less advanced cases. The bowels should be kept free but not loose unless there is a decided edema, when a portion of it may be removed by vigorous catharsis, which should be of saline type rather than the drastic. Magnesium citrate is one of the most valuable of this type. Magnesium sulphate in doses of sixty grains given hourly is good. Among the drastic cathartics elaterin is probably one of the best to be given in doses of $\frac{1}{3}$ to $\frac{1}{8}$ of a grain per orem, or eserine in doses of $\frac{1}{100}$ grain hypodermatically. Potassium acetate or citrate is of value in cleaning out the tubules and these should be in doses of about 10 to 30 grains three times a day.

Surgery is not indicated in these cases, while drugs internally give but little relief, although occasionally those given as a diuretic, as potassium acetate or citrate, magnesium sulphate, or digitalis are among the most useful by mouth. Subdermally we use physostigmin salicylate in doses from $\frac{1}{100}$ to $\frac{1}{50}$ of a grain.

Physiotherapy offers much for these cases and is usually given in the form of visible light for a period of time that does not produce exhaustion. This may be anywhere from five minutes to several hours unless the electric light bath cabinet is used, when it should not exceed five or ten minutes. This is followed by actinic rays beginning with a one-minute treatment with the air-cooled lamp and increasing one minute each day until periods of eight or ten minutes are reached. These treatments should be daily until there is definite improvement and then less frequently

as indicated. The bath cabinet is undoubtedly the best treatment for such cases as can stand the exhaustion of this treatment.

There are many complications of chronic parenchymatous nephritic cases, chief among these are the arterial changes, i.e., arteriosclerosis, myocarditis, endocarditis and the dilated or hypertrophied heart with or without compensation. If there is good compensation little damage is done as far as the patient's general mode of living is concerned, while with dilatation (particularly acute dilatation) the symptoms become grave indeed and perfect physical and mental rest must be insisted upon as well as a sitting posture. Arthritis is likely to develop in these cases as a complication, particularly if there is a bacterial invasion for an etiological factor. Hemorrhages may occur in these cases.

In carrying out this treatment other organs of the body must be protected as much as possible so that they will not be compelled to carry the extra load imposed upon them for unnecessary lengths of time.

The length of time these cases will require treatment will vary with the stage at which the patient is seen, but as a general statement one may say that they will require watching for years although the active symptoms may be relieved and the patient restored to his usual occupation or possibly to a lighter one in from one to six months. If these cases have a bacteriological factor, sodium iodide 32 grains and guaiacol $\frac{3}{4}$ of a grain, intravenously are of value.

Diathermy is of value in these cases and should be given through each kidney separately and to the point of tolerance only. Use composition metal (22 B and S gauge) electrodes, size 4x5 inches, one anteriorly and one posteriorly over the kidney. The milliamperage should be from 200 to 500 and the time ten to thirty minutes for each kidney. The length of the treatments should be increased very gradually.

Following physiotherapeutic treatment, the albumin and casts should be diminished in two or three weeks and in many cases they are entirely eliminated in from one to three months.

The prognosis in these cases is usually grave although many of them may regain a fair degree of health. The average length of life is from one to three years if untreated.

Nephritis, Chronic Interstitial.

Chronic interstitial nephritis is a chronic inflammation of the kidneys with the formation of connective tissue and following this the atrophy of the organ as a whole (small contracted kidney).

The exact etiology of this condition is not known, but certain factors influence it materially, among which advanced age is the most prominent. Chemical or bacterial intoxication, which, however, must be of low grade, is undoubtedly an etiological factor.

Anything that puts an extra burden upon the kidneys, as overeating or drinking of alcoholic liquors, tends towards sclerosis. Worry or anxieties from any cause is a factor, while high nervous tension adds to the damage already done. Exposure to rapid and extensive changes of temperature without adequate protection undoubtedly plays a part.

The pathology is given in the description of the disease, which is the contraction of the kidney substance and it affects all of the secreting structures as time goes on. The early connective tissue formation in this type of nephritis occurs in various parts of the kidney so that all parts are not affected at once. The urea is diminished. Microscopically there are hyalin and fine granular casts with perhaps a few leucocytes or a few erythrocytes. Bleeding is occult only. Total solids are diminished.

Many of these cases undoubtedly have as their etiological factor, the uncured cases of acute and chronic parenchymatous nephritis due to the infective fevers, either eruptive or intestinal, or of constitutional diseases.

This disease has a very long course and may be developing insidiously for many years before it is diagnosed and then only on the urinary findings, which speaks volumes for an annual thorough physical examination with increasing age.

One of the cardinal symptoms of this disease, although it does not occur in every case, is the albuminuric or nephritic retinitis. When it does occur it is pathognomonic. Retinal hemorrhages frequently occur, although they are not cardinal symptoms. As the disease progresses the total quantity of urine excreted in twenty-four hours is materially increased and may amount to several quarts, a distinct polyuria. While diabetes may give the same quantity of urine in twenty-four hours, its specific gravity ranges from 1.030 to 1.040, while the specific gravity of a chronic interstitial nephritis may be as low as 1.002 and seldom above 1.010. The blood pressure is usually high, 200 and up to 300 mm. of Hg.

Among the later and usual symptoms accompanying chronic interstitial nephritis will be drowsiness, general lassitude, disordered stomach, headaches, failing vision, dyspnea and, of course, late in the disease uremic symptoms. Dyspnea seldom becomes marked until there are marked cardiac changes due to the extreme contraction of the kidney, thus throwing extra burdens upon the heart action. Dyspnea is, many times, due to a dilating heart or an uncompensated heart rather than to the edema such as is found in the chronic parenchymatous nephritis. Edema may accompany the late stages of this disease. It is then associated with failing compensation.

A general arteriosclerosis usually accompanies this disease and increases in severity as the kidney becomes contracted. General pruritis with an accompanying eczema is not a rare late symptom.

There is no definite blood picture.

In diagnosis it must be differentiated from acute and chronic parenchymatous nephritis and from diabetes. With the oncoming edema it must be differentiated from cardiac diseases of various types. It may be wholly unassociated with chronic parenchymatous nephritis.

The general management of these cases will require as strict a hygiene as possible, moderate exercise and relief from business worries or anxieties. Diet should be decreased in quantity rather than in quality but the strict milk diet of the parenchymatous nephritic need not be insisted upon. A liberal diet of fruit and vegetables with eggs and milk in predominance is advantageous. Heavy starches and sugars should be used in limited amounts only, and this because of the impaired digestion and inactivity.

The bowels must be kept loose but not diarrheic. These patients do best in a climate in which there is an even temperature. Extremes of either heat or cold are bad. If the above condition can be carried out, these cases may live many years in fair comfort and pass away with some intercurrent disease.

Surgical treatment of decapsulation has been used and probably has helped a few cases of acute parenchymatous nephritis but it must be recommended with extreme caution.

The general management of these cases is of more importance than drugs, which are of little value either to stay the disease or correct the condition and when used should be only for symptomatic treatment and relief.

Physiotherapy has but little to offer in these cases except to increase the general nutrition of the patient and in this the general visible-light and actinic-ray treatments are of value. The average length of life is from ten to twenty years.

Neurasthenia.

Neurasthenia is a functional exhaustion of the tissues due to excessive waste from any cause. There are no special types of the disease although there are many gradations.

Any disease which lowers nerve resistance or any employment or occupation which destroys more tissue than one is able to rebuild may be an etiological factor. This pertains more to emotional disorders than to overwork from physical occupation. The latter is usually restored by a night's sleep, while emotional exhaustion frequently interferes with sleep.

There is no definite pathology except that of the etiology.

The blood picture will be that of any disease which causes anemia or that which accompanies any infection.

The cardinal symptom is fatigue accompanied by lack of control of the emotions. This lack of control, however, is entirely different from that of hysteria, which is usually a forced emotion while neurasthenic emotion is one out of the control. Therefore neurasthenia must be looked upon as a symptom of many diseases

rather than as a special disease entity and must be so considered in the diagnosis of the case.

If the case is examined carefully the underlying etiology with its definite diagnosis will be found. Any set of symptoms may accompany nervous exhaustion.

This condition must be differentiated from hysteria, hypochondria and melancholia.

The general management of these cases will be largely that of the underlying etiological factors. Hygiene and care of the case must be of the best. Exercise must be limited to the existing disease and the mental state of the patient. Rest, likewise, will be a factor that will tax the best judgment of the practitioner. Some cases will require absolute rest in bed while others must be compelled to take graduated exercises. In most of these cases, a light diet is to be preferred to a heavy one although in undernourished individuals the diet may be pushed. While the bowels require special care in neurasthenics, they must not be kept diarrheic on account of the exhaustion. On the other hand if diarrhea is present, it must be controlled as soon as possible.

In the treatment of this functional disorder, surgery will play an important part in the correction of definite pathology. Drugs must be used with extreme care particularly those of the sedative or hypnotic type and when these are required it is best to use some form of sedative physiotherapy rather than drug therapy. This applies to drugs used by any method.

Sometimes a small dose of strychnin to tone up the nerve force is of value and this dose should be about 1/100 of a grain two or three times a day. If neurasthenia occurs during the climacteric, corpus luteum given intravenously one cc. every second day will often give immediate relief.

After the removal of the etiological factors, the treatment of neurasthenia is generally the same as the general management of the case. Some forms of physiotherapy aid in the correction of the certain symptoms or disease conditions, and rest is more often required than physical exercise. To those overworked, change of occupation or environment may be all that is needed. Correction of eye strain alone will restore many of these cases. Wier Mitchell made his reputation on the care of this class of cases by what he termed "rest cure." However, there must be, combined with this, the best possible general management of the cases regarding exercise, diet, and general habits of body and mental control.

Hydrotherapy, massage in many forms, and the application of actinic rays do away with the need of drugs in most of these cases.

Among the modalities most useful for neurasthenia are visible light and actinic rays, vibration, high-frequency currents, galvanism, faradism, slow sinusoidal current, or slow sinusoidal super-

imposed by rapid sinusoidal, manual massage, hydrotherapy, and unless there is a localized diseased area, these treatments should be general rather than local.

Complications are those of the underlying etiology.

The average length of time these cases will require treatment will be from weeks to months.

The prognosis of the functional case is good otherwise it is that of the underlying etiological factor and remember that a neurasthenia may accompany an advanced case of malignancy as well as a psychic disorder.

Case No. 123. Female, age 44. History as follows: She had an attack of coryza in January, 1916; later she was treated for typhoid fever for several weeks. This case was finally diagnosed a pyosalpinx and operated June 5, 1916, when the right ovary and both tubes were removed, followed by abdominal and vaginal drainage. She remained in the hospital six weeks. She came to us September 25, 1916, a typical postoperative neurasthenic. She was exceedingly nervous; her appetite was poor; digestion worse; bowels fairly regular; no headaches; temperature 99; pulse 76.

Blood count at this time showed:

Hemoglobin	75%
Color index	95
Erythrocytes	3,900,000
Leucocytes	8100
Polymorphonuclears	62%
Small lymphocytes	30%
Large mononuclears	7%
Eosinophiles	1%

On November 16th the following change had taken place:

Hemoglobin	85%
Erythrocytes	5,400,000
Leucocytes	9000
Polymorphonuclears	67%
Small lymphocytes	25%
Large mononuclears	4%
Eosinophiles	1%

Her treatment consisted of from ten to twenty minutes with the visible light followed by from three to ten minutes with the actinic rays from the air-cooled lamp at a distance of twenty-four to fourteen inches, both over the entire torso. Treatments were given daily for one week until improvement began and then three times a week for one month, after which they were twice a week for four months, although she had very few symptoms after the first two months. We saw this case recently and she is in splendid health. What the operation could not do, actinic rays did do: restored her to health.

Neuritis.

Neuritis is a distinct inflammation of the nerve involved and may be typed as local or general, also as single or multiple.

The etiology may be exposure to cold, injury, or infection from any bacterial disease within the body, also from chemical poisoning.

The pathology consists of an inflammation due to a bacteriology, to an injury or exposure to extremes of temperature. If the disease is allowed to continue for any length of time, there are connective-tissue growths with more or less permanent damage to the nerve, and functional paralysis of the parts supplied by the nerve. The pain is due to the swelling of the nerve within its sheath.

The bacteriology is that of the underlying etiology.

In diagnosis it must be differentiated from simple neuralgia and from pain-producing diseases.

Its cardinal symptom is pain upon pressure along the nerve trunk. The most common types of neuritis are those of Bell's paralysis or inflammation of the seventh cranial nerve, brachial neuritis, and sciatica.

Before beginning any treatment, it will be necessary to clear up the diagnosis excluding all pain producing diseases. If these are found, treatment must be directed to them first and to the neuritis afterwards.

General management. Hygiene must be good, exercise limited to those in whom it will not increase the pain, and rest of the part involved. Diet need not be restricted unless it has a deleterious effect upon the underlying etiological factors. The bowels should be kept free and constipation corrected.

Surgery is rarely indicated in the treatment of neuritis. Drugs internally are usually used for sedation, but occasionally a drug like gelsemium in material doses of the fluid extract will tend to cure the disorder. Intravenous injections must be directed to the bacteriology, except corpus luteum which is often of distinct value in the treatment of so-called multiple neuritis of the climacteric. Drugs locally are usually of the counter-irritant type.

Physiotherapy offers much for these conditions. The modalities most useful are visible light, actinic rays, high-frequency currents, galvanism, and infra-red rays.

The average length of time these cases require treatment will be from a few treatments to several weeks. Bell's paralysis yields readily to visible light and actinic rays for the first two weeks, followed by the slow sinusoidal current or super-imposed wave (slow and rapid sine) current as soon as the active inflammation has subsided. The indifferent pole is placed in the upper cervical region, the active pole over the paralyzed muscles. The frequency of alternations should be from ten to thirty per minute for ten minutes daily at first, then at lengthening intervals. The quantity

of current should be just sufficient to contract the damaged muscles, meanwhile the patient should be instructed to use his willpower to aid in the contraction. He will thus aid materially in the restoration of function.

Complete function is rarely restored in these cases. The visible light should be used over the face and upper part of the body for fifteen to thirty minutes, to be followed by a local application of actinic rays sufficient to produce a mild blistering.

The prognosis will depend upon the underlying etiology, for it must be remembered that many of these cases accompany syphilis, alcohol and chemical toxemias, general infections, malaria, tuberculosis, diabetes, and intestinal auto-intoxication. Bell's paralysis of the seventh cranial nerve is almost invariably due to exposure to cold winds, injury or pressure.

The treatment of neuralgias, neuritis, sciaticas so-called, is anything but simple. The results of the treatment will depend largely upon one's ability to make the proper diagnosis and to remove, if possible, the etiological factors.

Case No. 52. Male, age 63. Was sent to me November 18, 1924, suffering from pain in the right shoulder which began several months before. This pain had grown worse despite treatment and now extended down into the fingers. There was pain on pressure, no swelling, edema, or redness.

He was given diathermy through the shoulder (500 ma. for thirty minutes). These treatments were given daily. There was some relief after the first treatment and complete relief after the third. He had seven treatments in all. Six months later he called at the office to say that there had been a slight return of the pain but two treatments were sufficient to bring complete relief.

DIAGNOSIS: Brachial Neuritis.

Neuralgia.

Neuralgia is a functional disorder of nerve trunks and is classified both by etiological factors and by the nerves involved, usually the latter.

It usually occurs during middle life and in neuropathic individuals. It may be a toxic condition or it may be due to exposure to cold or to trauma. It is a frequent accompaniment of secondary anemia, cachexia, and autogenous toxemias. It is an accompaniment of the most infectious diseases and is almost invariably found in the late stage of diabetes mellitus.

The underlying pathology is that of the underlying etiology, for it is a functional nervous disorder without inflammation so it carries no individual pathology.

Its cardinal symptom is pain which may be along the course of the nerve but usually at the terminal filament.

There is no definite blood picture.

The diagnosis is based upon the one symptom—pain. It must be remembered, however that many diseases have this symptom, so it must be particularly differentiated from a neuritis with its pathology of inflammation, and from the myalgias which always show muscle pain upon pressure. It must also be differentiated from the metatarsal pain due to damaged or relaxed arches, from pain accompanying an exostoses on the os calcis, from pain about the head and face due to exostoses within the nose, from pain about the coccyx due to fractures, or the pains of a sacro-iliac relaxation and from tic douloureux. Therefore no case should be called neuralgia until the diseased conditions causing pain are eliminated.

The general management of these cases will depend largely upon how much the patient is disabled. Many will be able to go about their daily business cares with neuralgia in the upper extremities when they could not if it were in the lower extremities. While movement sometimes aggravates the condition, complete rest in bed is seldom necessary. These cases do not require any special diet although they should be under- rather than over-fed. Exception might be made to this rule in cases of secondary anemia when the diet will be that of the underlying etiological factors. The bowels must be regulated but not kept loose.

In treatment, surgery is seldom of any value. The same may be said of the various injections although both at times gives temporary relief. Internal medication does but little for these cases, the same may be said of subdermal. Intravenous medication is of value if there is an infective process. A local counter-irritant is at times of value.

Physiotherapy offers much for relief of these cases. The methods most used are visible light, actinic rays, high-frequency currents, galvanism. Detailed treatments are hard to describe because of the various factors causing neuralgia, and the varied locations in which the condition is found, therefore the details of the individual treatments are left to the judgment of the physician in charge.

A.M.A. Jour., Jan. 31, 1925, Page 404, quotes Lichnitzki in Paris Medical 505-532 (Dec. 21, 1924) as stating, "The ultra-violet rays relieve the pain of neuralgia and neuritis and at times cure."

Complicating factors are those of the etiological disease.

The average length of time these cases require treatment will be from a few days to several weeks.

The prognosis is usually good as to life but in cases like tic douloureux they may continue for years despite treatment.

Onychia.

Onychia is an inflammatory disorder of the matrix of the nail having a bacteriologic etiology.

The pathology is that of an infection, many times introduced with a foreign body, spreading through or along the matrix and temporarily destroying its function. The nail is usually restored after the infection has been destroyed.

It must be differentiated from eczema, ringworm, and like disorders.

In the general management of these cases, cleanliness must be insisted upon. The area should be protected from outside infection.

Surgery may be necessary to remove the nail. Drugs used locally are frequently of value, such as aluminum acetate or magnesium sulphate in a saturated solution. A solution of the latter should be used to aid in the prevention of the scab formation. Other drugs as the silver salts in a five to fifty per cent solution, or boric acid in a saturated solution may be used. The best treatment for these cases after surgical intervention, if such be necessary, is the use of actinic rays from the water-cooled lamp given for about one minute daily until the infection is overcome.

Complications are rare, although occasionally an osteomyelitis may develop if the inflammation or infection extends into the deeper tissues.

The average length of time these cases will require treatment is a few days.

The prognosis is almost always good if properly treated. If the nail persists in growing laterally into the tissue, the use of the high-frequency spark to destroy the matrix is of value. This is easily done under local anesthesia.

Osteitis.

Osteitis has much the same etiology and pathology as osteomyelitis with the exception that the osteitis is usually the result of injury to the surface of the body followed by infection. Pneumonia, typhoid fever, and influenza frequently precede the osteitis. Should destruction (necrosis) take place, it should then be treated as an osteomyelitis.

Pain, which is usually described as deep and boring, is the cardinal symptom and is made worse by anything which increases the congestion.

There are many forms of osteitis, all of which vary somewhat in pathology. The principal changes, however, are thickening of the shaft of the bone particularly the cortex as well as thickening of the periosteum.

The differential diagnosis is from syphilis, Paget's disease, osteitis fibrosis cystica, and sarcoma and carcinoma which are rare and usually secondary.

Acute osteitis (not osteitis deformans or Paget's disease) is best treated with visible light and actinic rays and usually these

are the only treatment needed. However, if infection occurs, surgery is indicated but should be followed by phototherapy. If the lesion is small, the water-cooled lamp will be all that is required and should be used over the lesion for one to five minutes at a distance of about one inch. Treatments should be daily until there is definite improvement, then less frequently. If the source of the infection can be found, it should likewise be treated with the water-cooled lamp. Should the patient be debilitated from any cause, general visible-light and actinic-ray treatments should be given.

Case No. 509. Female, age 18. Eight years ago she had a compound fracture of both radius and ulna at the junction of the upper and middle third. For the past five years it had pained her constantly. One year ago it was operated, with one month's relief; since then pain has been more intense. The X-ray picture immediately following shows an apparent osteitis fibrosa.

She was given general visible-light and actinic-ray treatments starting September 21, 1918. These were followed by an actinic-ray treatment with the water-cooled lamp, given from one to five minutes. She was given a treatment every other day for the balance of September and all of October. She reported December 12, 1918, that there was very little pain since the last treatment.

DIAGNOSIS: Osteitis Fibrosa.

Osteomalacia.

Osteomalacia is the softening of the bones, usually of the spine and pelvis, and occurring almost invariably in pregnant or nursing women. It might, with all propriety, be called the rickets of adults.

Endocrine dysfunction may influence these cases, although the real etiology is unknown. While the parathyroids influence calcium metabolism, there may also be a dysfunction of other glands, particularly the adrenals. There is also a disproportion between the normal amounts of inorganic phosphorus and calcium. Decalcification is responsible for the softening and it is during this time that flattening of the pelvis occurs, and this is due to pressure from the heads of the femurs.

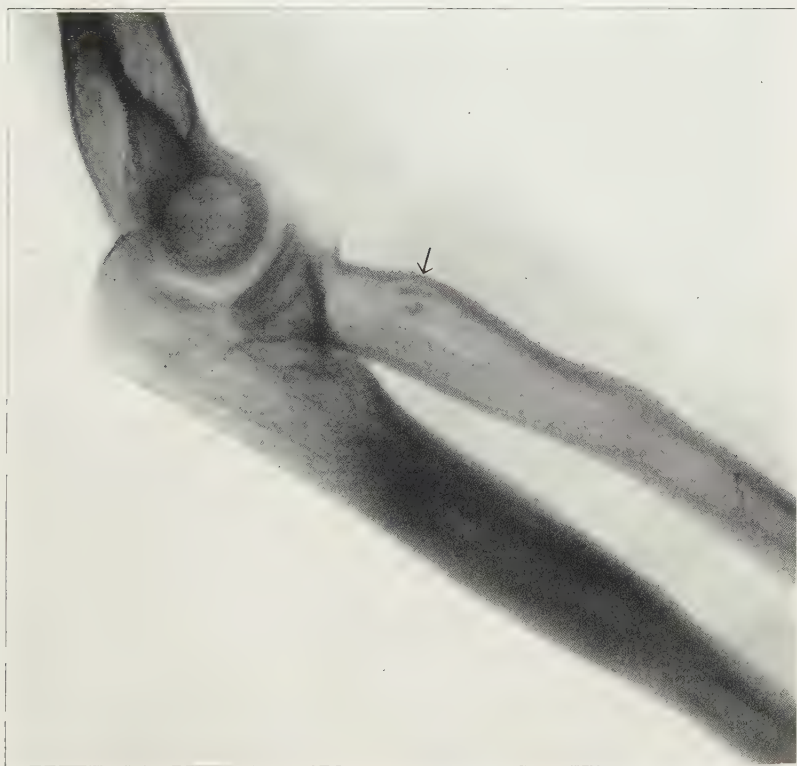
The pathology is given above.

Early symptoms are indefinite, but if the strength of the patient during pregnancy be kept in mind there should be no difficulty in diagnosing the condition early. If any symptom is cardinal in this disease it would be the waddling gait of these women after the softening has begun. Occasionally the disease is seen in childhood and only then when in the state of defective nutrition.

It must be differentiated from tuberculosis, malignancy and rheumatism.

Exercise must be limited, depending upon the degree of decalcification, and a diet of milk, fresh fruits or vegetables be in-

Case No. 509—Osteitis Fibrosa



Arrow shows diseased area near proximal end of radius.

Plate LI

sisted upon. These should be the ones that contain the greatest amount of calcium, as milk, fresh vegetables, etc.

Cow's milk contains 1.7 grams CaO to each 1000 grams of milk.

Surgical treatment is not needed and drugs are of little use. Cod-liver oil is the drug most likely to be of benefit, as it aids in the restoration of the balance between the calcium and phosphorus. This may be taken by mouth if the stomach will tolerate it; if not, it may be given by inunction.

Calcium cacodylate in doses of one grain may be given intravenously from daily to three times a week. Calcarea phosphoricum, fluoricum, or iodidum are at times of benefit—dosage 1/100 of a grain three times a day.

Physiotherapy offers one of the best methods of treating these cases. General visible-light and actinic-ray treatments should be given with local treatments from the water-cooled lamp over the bones most involved. The actinic rays excite much the same stimulus to proper endocrine function as does cod-liver oil, and while each might replace the other if one was not available, they are, however, decidedly synergistic. This line of treatment should increase the deposit of calcium salts, thus retarding the decalcification with very definite relief. The cure of this condition is hardly to be expected, although relief of symptoms means much to the patient.

The average length of time these cases will require treatment is several months.

The prognosis is good as to life, although the deformed pelvis is permanent.

Osteomyelitis.

Osteomyelitis is an acute or chronic infection of the spongy and medullary tissues of bone usually in the long bones or vertebrae.

The etiology is purely a bacteriology with staphylococci and streptococci as the usual etiological factors, although at times pneumococci or tubercular bacilli and colon or typhoid bacilli may gain entrance to the spongy tissues of the bones through the blood stream. Fractures are susceptible to infections. The usual infecting organism is staphylococci or streptococci in the long bones and tubercular bacilli in the vertebrae. This disease may occur first in childhood and at recurring intervals throughout adult life.

The pathology is bone necrosis. It may be gradual, extending inwards from a surface infection or large pieces of bone may be denuded and destroyed at one time which, when separated from the surrounding healthy bone, becomes a sequestrum. Trauma is seldom an etiological factor and is best illustrated by cases of osteomyelitis associated with paronychia.

There is no definite blood picture. If the disease continues for any length of time, there will be a secondary anemia.

The cardinal symptom of an osteomyelitis is a deep pain, the area of which is overlaid with edematous tissue. Usually one of the long bones is involved, although the spine is frequently affected; other bones less frequently. While it usually starts in childhood, it may occur or recur at any age.

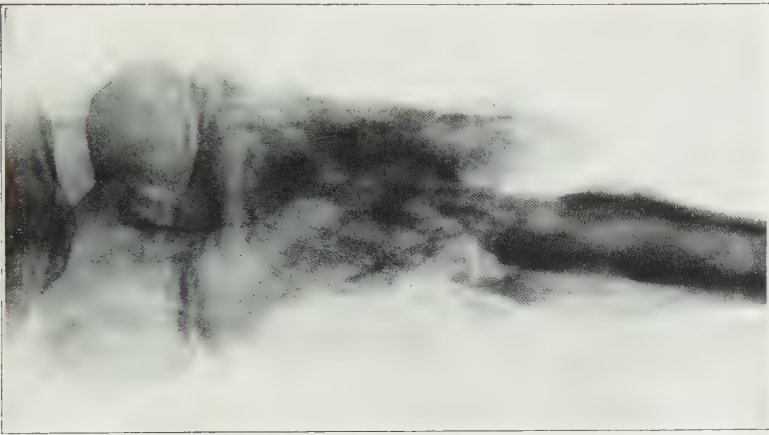
Among the usual symptoms are those of infection in any part of the body, a sharp rise in temperature, and an increase in the pulse rate, but in a few days after the infection has started in addition to pain (which may be similar to that of rheumatism, itself an infection) the overlaying soft tissues will become boggy, and as the infection spreads to the surface, the overlying tissues themselves become inflamed, red, and edematous. However the diagnosis should be easy in most cases.

In young children, one must be careful to differentiate it from other infections of a rheumatic or arthritic type, from injury, and from infective fevers. This is important for, if an osteomyelitis is allowed to run for a few weeks, for example, there is very extensive destruction of bone which could have been prevented by an earlier diagnosis.

The general management of these cases will be a good hygiene with exercise limited or prohibited if it causes pain, and in these cases rest is essential. Diet should be liberal and the bowels should be kept free.

The first treatment of these cases is immediate surgical drainage. This drainage should be not only to the periosteum and bone, but through the bone into the abscessed cavity which can be localized and the diagnosis cleared by use of roentgenograms. After drainage, drugs are of benefit to maintain nervous tone and to aid digestion. Intravenously sodium iodide, 32 grains, and guaiacol, $\frac{3}{4}$ of a grain, are of value as a definite control of the infective process. Drugs locally are not needed if physiotherapy is used, although saturated solutions of aluminum acetate or magnesium sulphate used as wet dressings give decided relief.

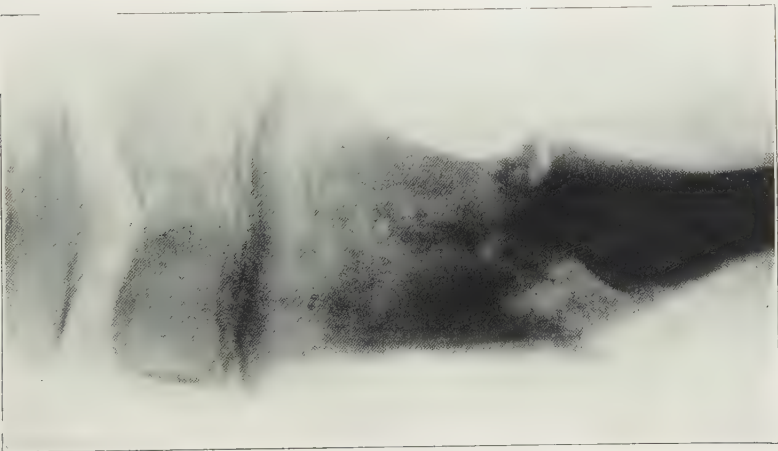
The principal physiotherapeutic modalities are general visible-light and actinic-ray treatments and the high-frequency currents such as diathermy. In the majority of the cases, general visible-light and actinic-ray treatments, together with local actinic-ray treatments from the water-cooled lamp at a distance of about one-half inch for one to three minutes over the area, will usually produce an early sterilization. Occasionally where a large sequestrum has been removed, diathermy through the diseased area will be of benefit by increasing the deep blood supply to the part. It should be given by placing the electrodes on opposite sides of the limb above and below the lesion, using an amount of current that is comfortable to the patient. Extreme care should be taken not to burn the surface tissues while using this current. The dia-



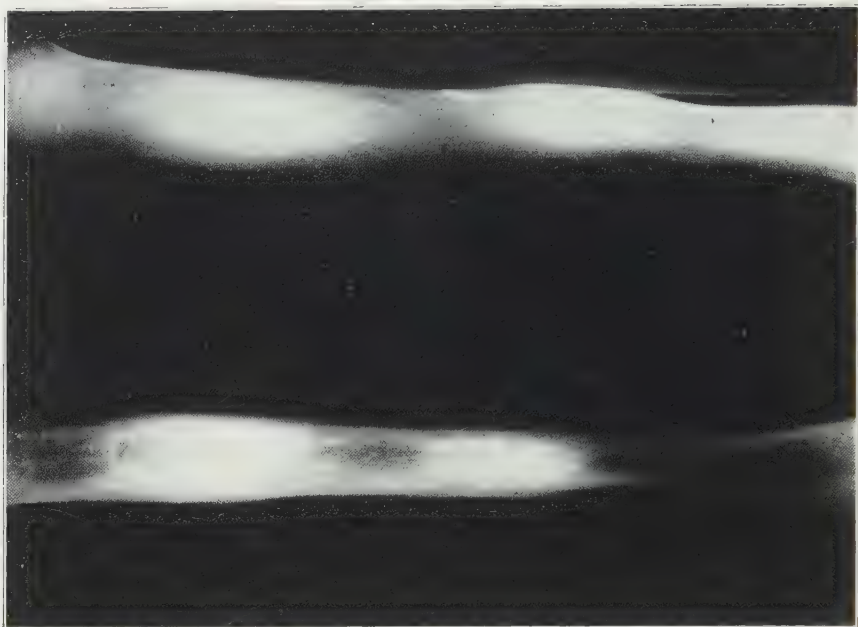
Osteomyelitis in child six years old.



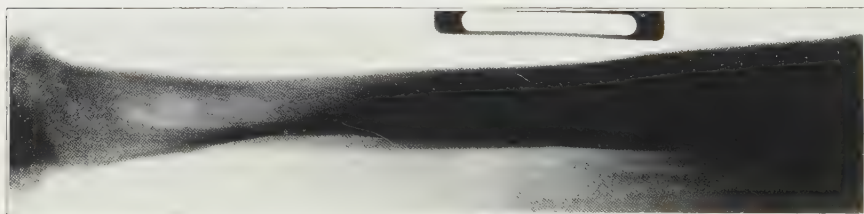
One week later after phototherapy.



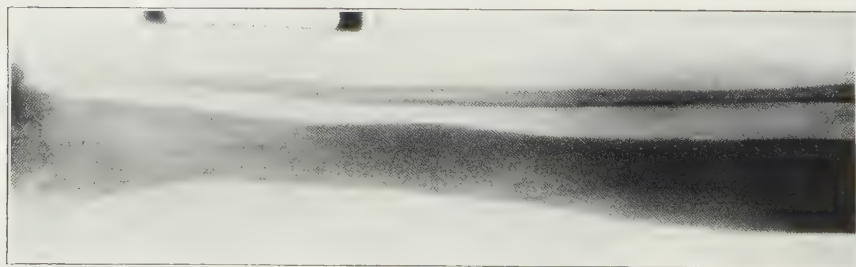
Condition after three months of visible-light and actinic-ray treatments.
Case No. 329.



Osteomyelitis of tibia showing abscesses at junction of middle and upper, and middle and lower thirds.



Same case one year later.



Same case. Visible-light and actinic-ray treatments had been given during the year. Case 494.

thermy treatment should be short, about ten minutes daily, to avoid intense congestion and consequent pain.

In draining these cases, it is not necessary to open the diseased area from one end to the other or to curette the cavities. The idea is to get simple drainage, then the actinic rays will take care of the balance of the infection.

The usual complications to be watched for are extension of the infection to other portions of the same bone or to other bones in the neighborhood and to other parts of the body. A few cases of empyema are on record as being metastatic from bone infections.

These cases will require treatment from a few months to a few years, the average being from three to nine months.

The prognosis is usually good as to life. When the joints are involved there will be loss of function. As a rule one may expect recurrences, as they frequently follow other methods of treatment.

Case No. 329. Female, age 7. Was referred to me November 10, 1925. The trouble was first noticed June 30, 1925. It was later diagnosed as an osteomyelitis of the right femur at the junction of the middle and lower third, and was first operated September 20, 1925, and was reoperated October 22, 1925, at which time several sequestra were removed.

At the time I first saw the case, November 10, 1925, there was a pathological fracture with about 4 inches of shortening. Drains were inserted into this area from three different openings. The child was badly emaciated and the wound draining freely.

General visible-light and actinic-ray treatments were started at once, giving the former from one to two hours and the latter for one minute, increasing one minute per day up to seven minutes. These treatments were continued at the hospital for two weeks, at which time she was taken home, where the lamps had been installed and treatments continued daily. February 12, 1926, three months after starting the treatments, the bone was practically regenerated with but one inch of shortening, the drainage had ceased, alignment and traction were maintained by Thomas splint.

See X-ray pictures both before and after treatment.

DIAGNOSIS: Osteomyelitis.

Case No. 494 came to us on October 26, 1922, with the following symptoms: Severe pain from the knee to the foot for the past three months, with a swelling and edema of the leg, ankle, and foot, most prominent above the ankle. There were several scars from former operations. The trouble began when he was between five and six years of age and since that time he had been operated four times. He is now thirty-three years of age.

Two months previous to coming to the office he began having pain in the upper third of the right tibia. X-rays taken at the Presbyterian Hospital, Chicago, at this time showed two abscesses,

one at the junction of the middle with the upper third and one at the junction of the middle with the lower third of the right tibia. There was no discharge at this time and because of the relief of pain from his first treatment no drainage was instituted.

The first treatment, on October 26, 1922, consisted of thirty minutes of visible-light over the chest and abdomen and one minute of actinic rays. The local treatment consisted of five minutes of actinic rays from the water-cooled lamp at a distance of about one inch. This gave him very decided relief and he was able to return to his work on the third day, or October 29th. The relief was constant. The treatments were about three times a week during November and December, 1922.

On March 3, 1923, X-rays were taken which showed the bone almost completely regenerated. On September 16, 1923, he returned with an abscess at the upper end of the tibia, which was found to be in the soft tissues only, as an X-ray taken at this time did not show further bone involvement. The treatments were continued until the first of December, 1923, at varying intervals of once or twice a week. At this writing, 1925, he is still in good condition. See X-ray plates.

DIAGNOSIS: Osteomyelitis.

Otitis Media.

Otitis media is an inflammation of the middle ear due to an infection which usually spreads from the nasopharynx through the eustachian tube. Occasionally it may be hematogenous.

The pathology is an inflamed and edematous mucous membrane which may go on to suppuration. This occurs only after there is occlusion of the eustachian tube. If at this stage the drum membrane does not rupture or is not lanced, the infection will extend into the mastoid cells where it will produce bone necrosis.

The cardinal symptom is pain, which is very severe and is throbbing in character. With extension into the mastoid cells there is a sharp rise in temperature and pulse rate and there may be delirium. As the infection spreads towards the surface, there will be edema and redness of the overlying soft structures. Meningitis is the outcome of untreated or improperly treated cases.

The treatment is surgery, drugs, and physical therapy. Silver salts are at times useful for the chronic suppurative case. Carbolic acid, 1% in glycerin, is of value to relieve the pain. This is dropped into the external canal. Surgery will be needed for the suppurative cases and all cases will need physical therapy both before and after surgery. Visible-light is useful for the early case to relieve pain and aid in the prevention of suppuration. It should be resorted to immediately, after which visible-light and actinic rays, both general and local, should be used. For the local treatments use the water-cooled lamp and a small quartz rod for the

membrane and external canal and the face of the lamp without applicators for the region over and around the mastoid process. The lamp should be held about one inch from the skin for one or two minutes daily for the first week, then less frequently as the case improves.

Otitis media cases will require treatment from a few days for the acute cases to months for the old chronic cases.

Ovaritis.

Ovaritis is an inflammation of the ovary, but as seen clinically it is seldom a distinct entity. It is found almost invariably associated with other inflammatory diseases within the pelvis.

Ovaritis may be either acute or chronic, as are other inflammatory conditions surrounding it.

The etiology of an ovaritis is practically the same as that of pyosalpinx. Gonococci, streptococci, and staphylococci are responsible for ninety-five per cent of the cases.

As to the pathology, the ovary becomes enlarged and edematous and occasionally contains serous fluid or pus. Pus may continue to form until it ruptures into the peritoneal cavity, causing a general peritonitis. On the other hand, the cyst may enlarge to any size, holding at times several gallons of fluid. If, however, the inflammation proceeds without cyst formation or pus and resolution takes place, the ovary may become fibrous and shrink to one-fourth or less of its normal size, its normal function being thus reduced.

The cardinal symptom of an ovaritis is pain throughout the pelvis, but upon digital examination it is found to be associated with the ovary because of the increase of pain upon pressure. The ovaries may be, and many times are, adherent either in the culdesac and along the side of the uterus and cervix or to the intestines or omentum. As it enlarges it prolapses into the culdesac unless held up by adhesions. These adhesions may disappear with the inflammation but are more likely to become fibrous and permanent. With the ovarian cyst there is an increased amount of pain during the monthly periods, which is radiated throughout the pelvis or up into the back, usually into the lumbar or sacral regions.

The accompanying symptoms are those of infection and inflammation anywhere in the body.

The diagnosis of a discrete ovaritis is often difficult, as most of these cases are associated with other pelvic inflammatory or infective troubles and it is impossible to separate the ovaritis from the salpingitis, endometritis, or pelvic peritonitis, which accompanies and are, many times, its etiology.

Chronic cases have much the same etiology as the acute. Blood or lymph stasis or anything that causes prolonged congestion of the pelvic organs is liable to cause chronic inflammation of

the ovary. In the chronic cases, the symptom pain is likely to be more or less continuous for a week before the menstrual period and, at times, there is menstrual intermission pain which may be felt most pronounced in the mammary glands. If the ovary becomes fibrous or scirrhotic, sterility is almost certain.

Ovaritis must be differentiated from pedicled fibroid tumors of the uterus, fibroid tumors of the ovary, or any other form of tumor on or about the ovary, uterus, or tubes. These can usually be diagnosed by digital examination. The inflamed ovary will be found to be sensitive and nodular and vomiting may be produced by pressure upon the mass. If the mass is due to any form of tumor, the acute sensitiveness of the ovary will be absent.

The treatment of these cases will be anything which will lessen the pain or inflammation. Rest in bed is necessary in the acute cases, while only restriction of exercise is necessary for the chronic cases unless it be at the menstrual period, when rest should be enforced. The diet in these cases, as with all pelvic cases, should be light and digestible. The rectum and sigmoid must be kept free of fecal matter. Constipation should not be permitted under any condition.

Treatment. Infections accompanied by adhesions and large cyst formations in the ovary will demand surgical treatment for their relief. Drugs internally as belladonna, bryonia, etc., are at times of use. In the infective cases, sodium iodide intravenously may be used cautiously in small doses of fifteen grains daily. Locally, applications of magnesium sulphate (saturated solution 25%) in glycerin used on tampons, give immediate relief by their refrigerant and hyroscopic action.

Salpingitis, which is frequently associated with cases of ovaritis, will be benefited by the same physiotherapeutic technique, which is largely actinic rays from the water-cooled lamp through a vaginal speculum for two or three minutes, two or three times a week. In the acute cases it is better to use it daily for about one minute. In addition to the local treatments, these cases do well to have a treatment of general visible light and actinic rays over the chest and abdomen. Occasionally galvanism will give these cases a decided relief. We use the copper-ball electrode on the positive pole. It should be covered with cotton and wet with a 5% copper-sulphate solution and should be placed in the vagina against the inflamed mass; the indifferent pole is placed upon the lower abdomen. Hot douches are effective if continuous, and are of decided benefit when other measures are not available. For the continuous douche use a return douche tube, because in this way the douche water can be used at a temperature of 120° F., a temperature the patient will not stand if it touches the skin.

Complications here are largely those of infection of the tubes or other pelvic inflammations as cellulitis or general peritonitis. Occasionally septicemia and pyemia supervene upon these cases.

The length of time these cases will require treatment will depend somewhat upon the pathology, somewhat upon one's ability to control the case; usually, however, for the acute cases from a few days to a few weeks, and for the chronic cases from a few weeks to a few months.

The prognosis is usually good as to life, but if the ovary is badly damaged by infective inflammation, it may become abscessed. Sterility will probably be the result, and in most of the cases it will be necessary to resort to surgery and do an ovariectomy. If the infection is confined to one ovary, the patient will still remain fertile. If the infection involves both ovaries, sterility is the natural sequence, together with an immediate climacteric.

In the treatment of these cases, X-ray, radium or any form of gamma rays are to be interdicted for the reason that they excite any inflammatory mass, although it has been quiescent for a number of years.

Case No. 67. Female, age 27. Was referred to me May 2, 1924. She gave a history of pain more or less constant in the left ovarian region for two years.

Physical examination showed a tender, prolapsed, adherent left ovary which was about normal in size. The pelvis was otherwise normal. During the next two months she was given eight vaginal treatments with the water-cooled quartz mercury-vapor lamp. Each of these treatments was two minutes in duration. There was relief of the pain after the second treatment and after the fifth, the pain entirely disappeared and the ovary was movable and of normal sensitivity.

DIAGNOSIS: Chronic Ovaritis.

Ozena.

Ozena has only one type and that is chronic atrophy of the nasal mucous membrane accompanied by ulceration and scab formations which harbor coccobacillus and foetidus ozena. Perez first described this disease with its characteristically offensive odor which makes the victim a social outcast. The sense of smell is usually destroyed. Pain is an infrequent accompaniment. Bleeding is rare.

Its etiology is not definitely known and has been variously described.

Its pathology is a localized ulceration usually upon the septum, although it may involve the turbinates.

The ulceration is persistent and progressive and frequently perforates the septum and at times destroys osseous tissue. It may occur in an individual otherwise in perfect health, although it is usually found in the anemic.

The differential diagnosis will be from syphilitic ulceration with necrosis of the bones of the nose and tubercular ulcerations which are rare.

The general management of these cases will require good hygiene and as perfect cleanliness of the nose as possible. Everything that will tend to build up the individual and to increase his resistance and immunity to bacteria should be used.

Surgery has accomplished but little in this condition, likewise drugs internally and subdermally. Intravenously sodium iodide, 32 grains, and guaiacol, $\frac{3}{4}$ of a grain, offer much assistance, and locally the use of silver salts, particularly argyrol or lunosol in ten to twenty-five per cent solutions, will be of value. Something to help prevent crust formation and to destroy the bacteria involved in the production of the offensive odor will be demanded. The use of a twenty per cent solution of oleum terebinthinae in oleum olivae is of value both for its antiseptic effect and to aid in the destruction of the offensive odor. At first it should be used on packs, later as a simple application, several times a day. The patient can be instructed how to use it.

Physiotherapy of a non-destructive type is of value in these cases, and this is principally the visible light over the face for one-half hour to one hour and a general body treatment with actinic rays to aid in building up the general resistance. This is followed by a local treatment with the water-cooled lamp, the rays being thrown into the nose and over the ulcerated area, after the scab has been removed. These treatments should be of a duration of one to three minutes and repeated daily until there is definite improvement, and then twice or three times a week. Following the actinic-ray treatments, pack the nostril with whatever drug solution seems best. High-frequency currents of the Oudin type are at times of benefit. They should be used through a non-vacuum nasal tube at a temperature comfortable to the patient and given for not over seven minutes each treatment.

These cases will require treatment for several months.

The prognosis is good. See case report, page 380.

Pancreatitis, Chronic.

Case No. 540. Female, age 7. Referred for treatment June 27, 1922, with a history of pale or white stools much of the time since she was one year old. Picture No. 1 gives a good idea of her general condition at this time.

January 27, 1922, Dr. Frank Smithies made the following report on her condition: Case No. A 4085. Personal examination January 19, 1922.

Major Disturbances—Infectious hepatitis with biliary stasis; cholecystodochitis and probably congenital anomaly of bile ducts; chronic pancreatitis with pancreatic deficiency; catarrhal gastritis and colitis; chronic gastric cirrhosis with rapid emptying.

Minor Disturbances—Infected tonsils.

(Signed) FRANK SMITHIES, M. D.

Stool examination March 3, 1922:

Free fat still in excess.
Fatty acids decreased.
Hydrobilirubin increased.
The free fat is well emulsified.
No meat fiber.
No starch.

(Signed) W. HENRY WILSON, M. D.

Urinary analysis April 26, 1922, No. 19604:

Color and odor normal.
Specific gravity 1.013.
Reaction, feebly acid.
Acidity, 1.5.
Urea, 1.2%.
Ammonia, 0.09.
P₂ O₅ 0.07.
Indican marked.
Urobilin, albumin, and sugar negative.
Acetone bodies positive.
Epithelium very abundant.
Round cells, middle layers and G. U. No other
microscopic evidence of disease.
Findings point to so-called food intoxication in
children, irritation of the genito-urinary tract.

(Signed) CLIFFORD MITCHELL, M. D.

A blood count taken at this time showed:

Erythrocytes	4,100,000
Leucocytes	11,900
Small lymphocytes	38%
Large mononuclears	2%
Polymorphonuclears	60%

On June 15, 1922, specimen (No. 19816) of urine examined gave the following:

Acidity low.
Specific gravity, 1.004.
Urea, 1.5%.
Indican slight.
Sugar and albumin negative.

(Signed) CLIFFORD MITCHELL, M. D.

We began her treatment with ten minutes of visible light and one minute of actinic rays from the air-cooled mercury-vapor lamp. On the 28th the time was ten and two minutes respectively. On the 29th the stool was yellow for the first time in months. Treatment at this time was ten and two minutes. On the 30th the stools were normally brown. The treatment on this date was ten and two minutes. At this time the limbs became edematous and

there was ascites. Urinary analysis, June 30, 1922, was as follows:

Specific gravity, 1.008.

Urea, 0.6%.

Indican marked.

Albumin and sugar, none.

Acetone bodies, no trace.

Findings suggest marked bowel disturbances.

(Signed) CLIFFORD MITCHELL, M. D.

Other visible-light and actinic-ray treatments were given on July 3, 5, and 6, 1922, at which time the edema and weakness were increased, but the mental symptoms were clearing up and the stools remained normal in color. July 15, 1922, a urinary analysis gave the following:

Specific gravity, 1.008.

Urea, 0.4%.

Ammonia, 0.73.

Indican marked.

Albumin and sugar, none.

Acetone bodies, none.

(Signed) CLIFFORD MITCHELL, M. D.

For the next few weeks the edema, ascites, and weakness continued, but with steady improvement. On October 16, 1922, the following stool examination was made.

Hydrobilirubin, normal.

Undigested starch, normal in amount.

Neutral fat is still slightly in excess.

Fatty acid crystals are present in small amounts.

I find no saponified fat crystals.

(Signed) W. HENRY WILSON, M. D.

About this time picture No. 2 was taken and is the best evidence of the efficacy of actinic-ray treatment in this disease.

Her father, who is a physician, adds the following: "I should like to add my own impressions on Donna's illness. During her second year she suffered with four severe tonsillar attacks, which attacks came at intervals of only three or four weeks. They were severe attacks with high fever of about ten days' duration. Tonsils gave little trouble after this, showed no evidence of chronic involvement, so were never removed.

"Following the last tonsillar attack a low fever developed and was present nearly all of the time for five months, accompanied by emaciation, pallor, pale and often white stools, marked abdominal distension and of course much impaired appetite. She was never jaundiced.

"Each year she had a recurrence of what I am pleased to call infectious hepatitis with biliary stasis; its onset often an-



Case of chronic pancreatitis during height
of attack. No. 1.



Same case after two months of visible-light
and actinic-ray treatments. No. 2.

See case report.

nouncing itself by several days of vomiting, then would occur several weeks or even months of impaired appetite, emaciation, pale, often white, stools. The abdomen became constantly distended. Fever might or might not accompany the onset.

"The most severe subacute attack occurred December 22, 1921, and continued at intervals until September, 1922. During the worst of this period for a few weeks she was too weak to walk, became edematous and a large amount of fluid filled the abdominal cavity. During this worst stage, actinic rays were used and it was following these treatments that the first indication in the way of yellow bowel movements was noticed, replacing the pale or white ones, which was always the beginning of improvement, but this improvement had never before been so long delayed. Emaciation and a fatal issue had never before been so imminent. Furthermore, recovery had never been so rapid before.

"The pictures taken hardly more than two months apart demonstrate how rapidly recovery can take place.

"There has never been another acute or subacute attack or any abdominal distension, although at times light colored stools are just a little in evidence. General health is very good to date, February 14, 1925."

During May and June, 1923, she had fourteen treatments of visible light and actinic rays, varying from one-half to eight minutes each. Since then she has remained well and the bowel movements are of normal color and consistency.

She is still in good health, June, 1926.

DIAGNOSIS: Pancreatitis, chronic.

Periostitis.

Periostitis is an inflammatory condition of the periosteum, usually due to injury or infection.

While it occurs with fractures, it may occur from direct blows of insufficient force to fracture bones which are not well protected by muscles, yet severe enough to cause a simple inflammatory reaction, which may go on to tumor formation. Should this inflamed area become infected through the blood stream or from without, we then have a typical osteitis which, if not properly treated, may become an osteomyelitis. Only occasionally does a periostitis follow one of the infective fevers.

The pathology consists of a thickened periosteum which, in many cases, becomes the depository of lime salts, thereby producing a permanent deformity.

While the diagnosis is usually easy, it must be differentiated from other injuries, fractures, dislocations, and other tumor formations. It is also essential in the early stages to differentiate it from an osteitis or from an osteomyelitis, and if occurring in the

course of or following one of the acute infectious diseases, special care will be needed to make an early diagnosis, for in this way only will it be found possible to avoid excessive and permanent injury to the individual.

The general management of these cases may be summed up in the one word—REST. This is absolutely essential if the injury is about a joint and if disabling deformities are to be prevented. The treatment is not surgical unless there is infection and then it should be drained immediately. Drugs internally have but little, if any, effect, likewise drugs used subdermally. If there is infection, sodium iodide, 32 grains, and guaiacol, $\frac{3}{4}$ of a grain, will be of value. Locally, drugs are of little use, although magnesium sulphate, in a solution of one ounce to a pint of water, kept on as a wet dressing to the splinted limb, will relieve pain by decreasing the amount of congestion and inflammation.

Physiotherapy offers much for these cases and the visible light and actinic rays are the best modalities to use. Only local treatments should be given unless infection of the underlying bone occurs, when general visible-light and actinic-ray treatments will be needed. Actinic rays from the water-cooled quartz-mercury lamp are usually sufficient unless the hyperemia persists, when the shorter actinic rays from radium will be needed to produce an endarteritis with obliteration of the involved capillaries and the reduction of the neoplasm.

The local actinic-ray treatments with the quartz-mercury lamp should be of a duration of one to three minutes, usually the former. The frequency should be daily to weekly at a distance of one inch.

For the subacute cases of periostitis due to slight injury, radium should be used in packs of 50 milligrams screened with $\frac{1}{2}$ millimeter of brass and 2 millimeters of rubber. The time of application should be from ten minutes to one hour, usually about one-half hour, about once in two weeks. Radium should not be used in the presence of pus. The local application of the quartz-mercury lamp should be continued in the interval.

Complications are usually an osteitis, an osteomyelitis, or, if general infection occurs, septicemia or pyemia.

The average length of time these cases will require treatment is from a few days to a few weeks.

The prognosis is good as to life and if cared for properly should be good as to deformities. Always remember, however, that rest of the part is the one essential feature in the treatment of the case.

Pernio or Chilblain.

Chilblain is a local inflammation which has for its etiological factor, cold just short of freezing.

Its pathology is an obstructed lymph flow.

Its cardinal symptoms are slight swelling, redness, intense itching, and at times intense pain, especially when heated.

Its diagnosis will depend upon the symptoms already given and must be differentiated from infection of the part, usually the side of the great toe or foot.

The general management will consist in the avoidance of further chilling of the part.

The therapeutic modalities useful are drugs and physiotherapy. Of the former, magnesium sulphate in a solution of one ounce to a pint of water applied as a continuous wet dressing, is invaluable. The area may be treated with actinic rays from the water-cooled lamp, applied for a period of one-half minute daily to thrice weekly.

Its complications are ulceration or infection, which must be treated according to their indications.

The average length of time the case will need treatment will be from a few days to a few weeks.

The prognosis is always good.

Pharyngitis.

Pharyngitis may be acute, septic, or chronic follicular in type. The acute cases have for their etiology a bacteriology usually staphylococcic, streptococcic, pneumococcic, diphtheritic, while the chronic follicular is due more to irritation from the plugged follicles than to any definite bacteriology.

There is no characteristic blood picture in this disease. The blood picture is that of infection in general with its high leucocytosis, the height co-ordinating itself with the temperature.

The cardinal symptom of the acute case is pain or discomfort particularly when swallowing. If the infection is severe, the pillars and soft palate will be edematous and temporarily paralyzed by pressure, and liquids will rise into the nasopharynx when swallowing is attempted.

The cardinal symptom of the chronic follicular type is irritation, particularly on getting chilled or from eating warm food; in fact, anything which will increase the congestion of the pharyngeal mucous membrane.

The diagnosis is usually simple as to the pharyngitis itself. The type of infecting bacteria can be ascertained only by smears and cultures.

Pharyngitis must be differentiated from tuberculosis, diphtheria, acute tonsillitis, streptococcic infection, and acute or chronic syphilitic ulceration.

The general treatment of the simple cases requires little attention, while, the contagious cases must be hospitalized and quarantined. The ordinary case, however, goes about his daily busi-

ness unless the temperature reaches 101° F. or more. Surgery is seldom indicated in these cases and then only for retropharyngeal abscesses.

Drugs internally, as belladonna, ferrum phos., aconite, and causticum are of benefit. Intravenously, sodium iodide is useful for acute infections.

Locally, alkalies, particularly magnesium sulphate, in doses of one-fourth to one dram in a glass of water, may be used as a gargle with decided relief, and some of it should be swallowed to reach the mucous membrane farther down the throat. External application of magnesium sulphate, one ounce to a pint of water, as a cold wet dressing, will also give decided relief.

Physiotherapeutic treatments consisting of actinic rays from the water-cooled lamp should give almost immediate relief in the acute infected type and if persisted in will give some relief to the chronic follicular cases.

The complications are usually the extension of the infection into the accessory sinuses above or downward into the larynx, trachea, bronchi, and lungs.

The average length of time these cases will require treatment is from a few days to a week or two at most, unless there is extension into the accessory sinuses or into the lungs, then the length of time will depend upon the disease produced.

The prognosis of the pharyngeal cases is good. The prognosis of the complication will depend upon the activities of the disease in that particular location.

Phlebitis.

Phlebitis is an inflammation of a vein anywhere in the body. These cases may be either acute or chronic.

The etiology is injury, infection, or both. Infections of all types, rheumatism, syphilis, infective fevers, tuberculosis, and cancer are all etiological factors.

Phlebitis may also be caused by intravenous injections of such drugs as the arsphenamin or mercury. In these cases it is of an aseptic type, causing obliteration of the vessels, although after the thrombus has formed, infection frequently takes place with abscess formation.

The pathology is an inflammation of the lining of the veins, together with the formation of a thrombus. Should this thrombosis become infected and fragments be carried about in the circulation, the infection may become general. Phlebitis may be an accompaniment of lymphangitis as the lymph vessels lie along the veins and the infection may spread through the walls of both. These cases are, many times, very serious, particularly so if the infecting organism is streptococcic.

The blood picture is that of an infection or a hyperleucocytosis.

The cardinal symptoms are pain and a red line over the vein if it is superficial. If the vein is deeply situated, there will be pain on pressure.

Phlegmasia alba dolens is a type of phlebitis, although limited to the iliac vessels. Should the infection be severe, abscess formation is likely. Phlebitis, especially where the deep veins are involved, must be differentiated from osteomyelitis, periostitis, osteitis, injuries and varicose veins, which are in reality a very low type of infective phlebitis with dilatation due to the weakening of the vessel walls.

The general management of the case will depend upon the area and extent of the involvement. As a rule, exercise should be interdicted and rest insisted upon, unless it is a very localized spot in one of the extremities. The diet should be light but nourishing and the bowels should be kept free. Surgical treatment is demanded for abscess formation in any part of the body. Internally, belladonna is of use. Subdermally, the autogenous vaccines may be of decided benefit. Intravenously, sodium iodide, 32 grains, and guaiacol, $\frac{3}{4}$ of a grain, are useful for the acute stage. After this has passed iron and nuclein may be used to advantage. Locally, magnesium sulphate (one ounce to a pint of water) may be used as a wet dressing either hot or cold, at the discretion of the patient.

Physiotherapy offers much for these cases. General visible-light and actinic-ray treatments should be given. These should be followed by local treatments with the water-cooled lamp for a period of about ten seconds for each area. Treatments should be given daily, or even twice daily, until the infection is destroyed.

Diathermy may help after the acute symptoms have subsided, and in exceptional cases may be used with caution in the acute stage, but only for phlebitis of the extremities.

Complications are abscess formation, pyemia, and septicemia. Metastatic abscesses may form in any organ or tissue of the body.

The length of time these cases will require treatment is from a few days to weeks or months.

The prognosis is good if the inflammation is limited to the veins; otherwise it depends upon the complicating factors.

Phlegmasia Alba Dolens.

Phlegmasia alba dolens is a swelling of one or both of the lower extremities due to an infected thrombi in the iliac vein.

Its usual etiology is postpartum infection, or it may occur during the convalescence from typhoid, dysentery, or extensive malignant or tubercular lesions within the pelvis. Occasionally it is due to a colon bacillus infection from adhesions of the sigmoid.

Quite frequently it occurs following operations within the pelvis which need not be in the thrombosed area.

The pathology is a thrombus formation within the iliac vein on one or both sides and one side may follow the other after a period of a week or more; usually, however, it is unilateral.

The cardinal symptom is the swelling of the leg on the affected side. The usual accompanying symptom is slight pain or discomfort in the leg, which may occur before the swelling takes place. The discomfort in the leg is usually described as dragging rather than as an acute pain. As the swelling increases, naturally the limb becomes heavy and more or less unmanageable.

In diagnosis it must be differentiated from edema, associated with heart lesions, or any interference with the portal circulation. It must also be differentiated from the edema of varicose veins and ordinary phlebitis of the veins of the leg. However if its etiology is sufficiently considered, there should be no difficulty in making a diagnosis of phlegmasia.

There is no definite blood picture, although the leucocytes are usually in excess of the normal.

The general management of these cases consists of rest in bed during the acute period, which will be from one to four weeks. During this time the diet should be light and the bowels kept free, not necessarily loose. As soon as the acute symptoms and the slight fever which accompanies this disease disappear, exercise should be cautiously begun which, however, should be passive and not active. Massage should not be permitted under any condition; neither should vibration.

Surgical treatment is seldom needed or called for. Drugs have but little effect subdermally or internally; intravenously, sodium iodide, 32 grains, and guaiacol, $\frac{3}{4}$ of a grain, are of benefit for the infection. Locally the application of compresses of magnesium sulphate, one ounce to a pint of water, will give decided relief. Elevation of the leg, particularly the foot, should be continuous and this should be sufficient to bring it above the pelvis.

Physiotherapy offers much for these cases. General visible light and actinic rays are the best modalities to use. Follow this with a prolonged visible-light treatment to produce a good hyperemia over the upper portion of the femoral vein, the lower abdomen, and over the involved internal iliac vein. Diathermy may be used in the late stages, but should not be used the first month or two.

The complications which usually accompany this condition are inflammation and suppuration in various parts of the body, due to the fact that pieces of the infected thrombi are released into the circulation where they remain until the vessels become too small for their passage. At this point the infection spreads through the surrounding tissues. Pneumonia should be watched for, as the lungs are one of the places where emboli frequently find lodgment.

The average length of time that these cases will require treatment is from weeks to months.

As far as prognosis is concerned, serviceable results are to be expected, although few of these cases ever completely regain the function of the iliac vessel. There will be more or less swelling, particularly during cold damp weather, and muscle atrophy is likely to take place from lack of normal exercise.

General weakness of the limb almost invariably prevails for the balance of the individual's life.

Unless septic thrombi complicates the case, the prognosis is good as far as life is concerned.

Pityriasis Rubra Pilaris.

Pityriasis is characterized by the small, conical, drying papules which form about the hair follicles, running a chronic course and tending to spread.

Its etiology is similar to that of lichen in that it is a digestive disturbance upon a neurotic base, probably the result of a toxemia.

Its pathology is a cornification of the papules surrounding the hair follicles. As the eruption spreads it tends to take on the red or purple color, from which it gets its name. It may be upon any portion of the body, but is more frequently found in the young than in adult life. Lichen attacks adults, pityriasis children or young adults.

In diagnosis it must be differentiated from lichen simplex and eczema. If one will remember the particular cornification which occurs about the hair follicle, no mistake needs to be made.

The general management of the case requires a good hygiene; the diet must be of fruit and vegetables.

The treatment. Drugs internally are for the necrosis and the digestive disturbance rather than for the local skin lesion. Intravenous injections of iron and nuclein are at times of value. Locally, drugs have very little influence upon the disease.

The physiotherapeutics of this disease are largely actinic rays and visible light as a general treatment, with an excess of actinic rays from the water-cooled lamp over the areas involved.

It has no complications but tends to recur.

The average length of time these cases require treatment is usually but a few weeks.

The prognosis is good.

Pityriasis Sicca and Oleosa.

Pityriasis or seborrhea is a dysfunction of the sebaceous glands. With seborrhea there is too little secretion and the cardinal symptom is fine branny scales which usually occur in the hair but may occur upon any portion of the body. In the opposite condition, seborrhea oleosa, there is too much secretion from the

gland, which produces greasy hair and scalp, and it may occur upon any portion of the body and is then vulgarly called an *oily skin*.

While the *etiology* of these conditions may be a pathogenic micro-organism, there is more likelihood of its being an endocrine dysfunction.

All sorts of maladies have been given as predisposing causes. It is quite possible that anything which produces an undernourishment or lowers vitality and general immunity in the individual will aid in the production of seborrhea. There will be no difficulty in diagnosing the disease, as no other condition closely simulates it.

The *general management* will be anything which will increase the general nutrition of the individual; particular attention should be given to the bowels to see that they do not become constipated. Drugs internally are those for the constitutional disorder and the same may be said of those used intravenously. Locally, sulphur in a ten to twenty per cent ointment with a petrolata or olive oil base rubbed into the scalp about three times a week will probably do the most for this condition. Antiseptics of the resorcin type are at times useful.

Physiotherapy in the form of actinic rays from either the air- or water-cooled lamp will benefit many cases. These treatments are given locally and for a sufficient length of time to produce a good hyperemia, two to ten minutes for the air-cooled lamp at a distance of eight inches, or one to three minutes for the water-cooled lamp at a distance of one inch. Treatments to be given once or twice weekly. The best results are obtained by combining general visible-light and actinic-ray treatments with the local treatments. These should be given three times a week. As most of these cases have a constitutional dyscrasia underlying the etiology, it is questionable if any physiotherapeutic measure will clear up these cases for any great length of time unless the constitutional disorder can be removed.

Pityriasis Versicolor.

Pityriasis versicolor is a parasitic skin disorder having for its etiology the microsporon furfur.

The *characteristic symptoms* are pin head maculae, which gradually coalesce, forming scabs of a faun color. The color may vary from yellow to brown.

The *diagnosis* is confirmed by the finding of microsporon furfur under the microscope.

For the *treatment* of these conditions, one may rely almost entirely upon the use of the actinic rays from the water-cooled lamp for one to two minutes at a distance of one-half to one inch. These should be given daily until there is definite improvement and then twice or three times a week.

Unless all of the microspores are killed, recurrences are certain.

Pleuritis.

Pleuritis may be classified as primary or secondary, also as acute and chronic.

Primary pleuritis is rare, while the acute is common, and is usually secondary to an infection in the lungs, mediastinum, or cardia.

The cases of chronic pleuritis are usually prolongation of the acute, therefore most of these cases are secondary to thoracic infections. Most of those which develop into a chronic pleuritis are tubercular in type, the infection spreading by continuity.

The chronic cases are of two types, the exudative and the dry. The exudative may be non-suppurative or if the exudative becomes infected, it will be suppurative or an empyema. The acute pleuritis case may assume the following forms, according to Sajous: fibrinous, serofibrinous, seropurulent, purulent, or hemorrhagic. The first three forms are of the acute type, while the latter two are chronic.

The etiology is usually an infection, although traumatism plays a minor roll. Among the primary etiological factors may be mentioned acute fevers such as typhoid fever, pneumonia, acute rheumatism, acute miliary tuberculosis, pericarditis, acute nephritis, and those affecting the mediastinum as neoplasms, Hodgkin's disease, and aortic aneurysm.

The pathology is at first a simple hyperemia which in acute infections rapidly leads to the exudative type. In slow infections, as in chronic tuberculosis, the hyperemia may produce the dry type which later may or may not become exudative. Among the bacteria frequently found in cases of pleuritis are staphylococci, pneumococci, streptococci, tubercle bacilli, and typhoid bacilli.

The dry form of pleuritis quickly develops adhesive bands with more or less permanent agglutination of the parietal and visceral layers. Where the infection is more severe and more rapid, there will be edema and thickening of the pleura with infections of the exudate producing a typical empyema, which may be general or localized in one or more spots by the adhesions.

The physical findings will be friction sounds in the dry or plastic types and dullness on percussion in the exudative types. The dullness due to exudation may shift with the position of the patient if it is in the general cavity, or be localized if surrounded by adhesions.

The cardinal symptom of the acute type is pain which is usually localized but may be general over one side of the thorax. The onset is usually sudden, with chills and a sharp rise in temperature and pulse rate. Headache and anorexia are accompanying symptoms. The pain makes respiration difficult, but is catchy rather than dyspneic. Bodily movements aggravate the pain. The ac-

accompanying cough is a symptom of the primary disease and acts as an aggravation of the pleuritis. Most of the pain of lung, mediastinal, or pericardial infections is due to the accompanying pleuritis.

There is no definite blood picture, although bacteria are at times found in the blood stream. At first there is a hyperleucocytosis, later there may be the picture of a secondary anemia.

This disease must be differentiated from pneumonia, tuberculosis, pancreatitis, cholecystitis, appendicitis, neoplasms of the mediastinum, and cardiac and pericardial infections accompanying acute rheumatism and acute nephritis. Intercostal neuralgia simulates it closely. Myositis of the intercostal muscles simulates it closely, but there is usually pain on pressure between the ribs. Myositis may accompany a pleuritis if the infection is intense. Nephrolithiasis may give a localized pain symptom similar to that of a pleuritis.

Treatment. The general management of these cases is usually the management of the primary disease. Should empyema develop, then the general management will be that of an empyema.

Surgery is at times needed for the purulent type, seldom for the dry or simple exudative types. Drugs are useful symptomatically, particularly bryonia in doses of 1/100 of a grain. Sedative drugs are seldom needed if a magnesium sulphate (1-16) solution is kept on constantly as a wet pack. Sodium iodide and guaiacol solution (32 grains of the former and $\frac{3}{4}$ of a grain of the latter) intravenously, help materially in the infective types.

If physiotherapy is available it is our best treatment. General visible-light and actinic-ray treatments are most valuable. The 1000-watt lamps should be used over the entire body and as near continuously as possible until relief and absorption begin, then the periods of application should be shortened and the interval lengthened. The distance of the lamp should be one that is comfortable to the patient, usually several feet. Actinic-ray treatments should be given daily or twice daily for a period of one minute or more, according to the reaction of the skin of the patient.

For the chronic cases, particularly if there are adhesions, diathermy is invaluable. This should be given through the involved area for thirty or more minutes daily, using a milliamperage comfortable to the patient. The electrodes of 22 (B&S) gauge composition metal should be about 4x6 inches, varied to suit the location and extent of the lesion. These should carry at least 1200 milliamperes without discomfort.

If there are signs of increased toxemia when the exudate begins to absorb, it may be necessary to discontinue the treatments for a day or two to avoid rapid absorption and extreme toxicosis.

Pleurodynia.

This is an acute affection of the intercostal muscles and at times of those overlying the chest wall.

The disorder is a true myalgia which may be produced by a traumatism (physical, chemical, or thermal), or by a low grade infection which is hematogenous in origin.

Its pathology is the locking in of toxins with lymph and blood stasis which causes the symptom pain. The pain is increased by pressure or motion.

The laboratory findings are negative.

The condition pleurodynia must be differentiated from fractures of the ribs, spinal caries, intercostal neuralgia, herpes zoster, pleurisy, and inflammatory diseases within the thorax which produce surface pain increased by motion.

Treatment consists of various forms of physical therapy of which visible light given for long periods of time is the most valuable. Use a 1000-watt bulb placed at a comfortable distance for an hour or more daily. Diathermy, using large electrodes for surface dispersion, is very valuable and may be used during the same treatment with the visible light.

Pneumonia.

While pneumonia can scarcely be classed as a disease which lends itself readily to physical-therapeutic treatments, yet there are times and cases in which these methods are of the utmost value. This is particularly true of the unresolved cases.

Pneumonia is an acute bactericidal disease having for its principal etiological factor the diplococcus pneumoniae of which there are four principal types. In addition to the specific diplococcus there is many times a mixed infection, particularly with the various streptococci and staphylococci.

In pneumonia there are two principal types of consolidation, first the lobar in which one or more lobes are involved, and the lobular in which but small portions or lobules are consolidated. In both types as one lobe or lobule clears another may become consolidated, thus continuing the disease with a frequent rise and fall of temperature. In the lobar type, this continuation may last as long as twelve days while with the lobular type it may last three or more weeks. If continued beyond this time, it means complications or non-resolution.

The cardinal symptoms are a chill followed within a few hours by dyspnea partially due to pain and partially due to rapid consolidation of a lobe. At this time the respiration becomes rapid (40 to 60 per minute) and there is an increase in pulse rate and temperature (the former to around 120 and the latter to around 102° to 104° F.). If the temperature is high, there is likely to be delir-

ium particularly in children. As the inflammation increases, there is an increased bronchial secretion which provokes coughing and increases the pain.

In the lobar type the expectoration is blood stained, giving the characteristic prune juice sputum. There is always a flushed area on each cheek resembling somewhat the afternoon flush of the pulmonary tubercular type. Herpes labialis is a common accompaniment. Vomiting is common in children, rare in adults. Tracheitis and laryngitis are commonly associated and are distressing symptoms which may be relieved by magnesium sulphate packs. Leucocytosis is common until the crisis when it gradually disappears and is an aid in differentiating typhoid, malarial and influenzal fevers, in which it does not occur.

During the stage of consolidation, there will be dullness over the involved areas whether this be a lobe or a lobule. In the latter case if the lobule is deeply seated, there will be some difficulty in outlining the area by percussion but auscultation will usually give an absence of the normal breath sounds over these areas.

Pleurisy usually accompanies the lobular type and always the lobar type and is the cause of the pain and adds to the dyspnea which is caused mainly by the consolidation which limits the amount of oxygen admitted. The lack of oxygen is in turn the direct cause of the increased respiratory rate. If the pleurisy is accompanied with effusion, a change of position will change the area of dullness. Should infection occur, the resulting empyema must be diagnosed and treated as a separate entity.

In all cases of effusion, it is well to aspirate some of the fluid for smears and cultures. This is the only way one can be certain of the exact condition. Pleuritic effusions frequently become absorbed with little disturbance if they remain sterile, but infection frequently means prolonged drainage. Roentgenograms will aid in diagnosing the case and locating the trouble. With delayed resolution, pulmonary abscess is a frequent complication. These usually rupture into the bronchi but may rupture into the pleura producing an empyema.

Pneumonia is to be differentiated from bronchitis, influenza, pleurisy, acute pulmonary tuberculosis, pulmonary infarcts with gangrene, pericardial effusions, and interlobular empyema. In children, meningitis is to be remembered but there is no lung involvement if not due to pneumonia or tuberculosis.

The general management of a patient suffering with pneumonia (all types) is rest in bed with the least possible physical effort. Fresh air should be abundant even in zero weather. Cleanliness is important. The diet should be liquid or better a fast for the first few days. The digestion is badly deranged and if the stomach is filled with food it cannot digest, acute dilatation is likely to

occur and adds a grave complication to the case. The bowels should be moved daily, preferably by enemas.

Surgery is needed at times to evacuate abscess formation either in the lungs or in the pleural cavities.

Drugs internally are useful symptomatically. Intravenously sodium iodide 32 grains and guaiacol $\frac{3}{4}$ of a grain are extremely valuable to combat this infection. Locally, magnesium sulphate (1/16) solution used as a wet pack is invaluable. Use the ordinary pneumonia jacket but keep it saturated with the magnesium solution which may be ice cold until the fever falls below 100° F., when it should be used at room temperature and as the fever falls to normal use heat over the pack to maintain body temperature. Continue in this way for two or three days after temperature reaches normal. Relief of dyspnea comes in about one hour after starting the use of the wet jacket.

Diathermy using a composition-metal pad electrode anteriorly and posteriorly to the involved area—each pad large enough not only to cover the area but an inch or two beyond—is extremely useful. If the patient is insensible to pain, extreme care must be used to avoid burns. See that the pads are in absolute contact with the skin and keep the milliamperage below forty per square inch of the smallest electrode. If the patient is conscious, the current may be used to tolerance. The length of the treatment should be from twenty minutes to one hour and may be repeated every twelve hours until relief is obtained, then less frequently.

These patients require treatments for one or more weeks.

The prognosis is good in all but the aged and debilitated or in the case that goes untreated until they are moribund.

Pneumonia Unresolved.

The cases that do not resolve normally, that is, within a week or two after the crisis, should be treated by physical means preferably by visible light and actinic rays. Diathermy may also be used for the acute condition, but is not necessary for the large majority of cases if the general-light treatments are given. These treatments should be given daily and it matters not whether they are started the second week or the fourth month post pneumonial. Relief is usually obtained after the first treatment. Two or three weeks is usually a sufficient period of time in which to clear up these cases.

Case No. 86. Male, age 34. Was referred to me February 26, 1926, at 11 A.M., at this time he was cyanotic and delirious. His temperature was 103.5° F.; his pulse 140; respiration 50 and intermittent.

Physical examination showed the right lung consolidated with beginning rales in the lower lobe of the left lung. He was given

diathermy (posterior electrode 5 by 7 inches, anterior 4 by 5 inches) through the upper lobe of the right lung, the first to become involved. The quantity was 700 milliamperes for forty-five minutes. Three hours later the cyanosis had disappeared and eight hours later he was given a second treatment using the same electrodes but this time I had the current traverse the middle and lower lobes of the right lung. Twelve hours later he was given a third treatment through the upper lobe of the right lung using 1200 milliamperes for one hour, and twelve hours following this he was given 1000 milliamperes through the lower lobe of the left lung as there was beginning consolidation. His subsequent treatments were twenty-four hours apart and were of 1200 milliamperes for one hour. He had thirteen diathermy treatments.

Five days after starting the diathermy treatments, he was given in addition thirty minutes of visible-light over the chest and abdomen and actinic rays from the air-cooled quartz mercury-vapor lamp beginning at one-half minute and increasing one minute daily up to five minutes. Fourteen days after the first diathermy treatment his lungs were clear and he was able to leave the hospital.

DIAGNOSIS: Pneumonia (lobar).

Case No. 663. Female, age 54. Case was referred Feb. 13, 1923, with the following history: She had pneumonia in November, 1922, from which she had not recovered and had been at home unable to work and under the care of physicians all of the intervening time. She still had severe pain in the thorax, which was made worse by jarring. Deep breathing was impossible and there was both weakness and stiffness in the joints which compelled assistance to get about.

Upon examination it was found she had rales through the lower lobe of the right lung and through the upper lobe of the left lung with consolidated areas in both lungs. Her first treatment was visible light for thirty minutes and actinic rays for one minute. Before the treatment was finished breathing became easier and deeper. On Feb. 14th the jarring did not bother her. She had treatments on Feb. 14th, 15th, 16th, 19th, 21st, 23rd., and by this time the lungs were clear and the knees less stiff.

She had treatments on Feb. 26th, 28th, and March 8th, when she was discharged with the lungs clear and she was able to return to her employment.

DIAGNOSIS: Pneumonia, unresolved.

Acute Anterior Poliomyelitis.

Infantile paralysis is an infectious disease whose bacteriology is an ultramicroscopic micro-organism. It occurs mostly in young children hence its synonym although it may occur at any age.

Three distinct types are recognized, acute, sub-acute, and chronic, although but two are usually seen, the acute or infantile paralysis and the chronic or progressive muscular atrophy of adult life. The chronic cases are usually found about middle life, seldom in the aged. The acute case is both contagious and infectious and an immediate quarantine should be enforced. The chronic case is neither contagious nor infectious so far as known.

The essential pathology is the destruction of the cells in the anterior horns of the cord although the infection is found in the surrounding tissues. Other organs as the kidney, liver, etc., are but slightly involved. These may be in one specific location thus affecting one set of muscles or there may be more or less of a general destruction throughout the length of the cord affecting the arms as well as the legs.

There is no distinctive blood picture although the leucocytosis of infection is present.

The cardinal symptom of this disease in the acute type is flaccid paralysis usually coming on while the child is at play. The paralysis is usually confined to one limb or one set of muscles, although it may be general over one side or be bilateral.

The symptoms preceding the acute paralysis, if noted at all, will be irritability, weakness, at times nausea and vomiting, general restlessness or malaise, and possibly a sore throat. At this time there is a slight elevation of temperature, usually around 101°, the pulse from 100 to 110. Severe cases may have the temperature rise to 106° F. or even higher. Headaches, back and limb pains similar to those found in influenza are at times among the prodromal symptoms. Convulsions are rare but do occur in young children. However, the symptoms just enumerated, while they may accompany other diseases, should always be regarded with suspicion in times of an epidemic of poliomyelitis. These early symptoms seldom last more than three or four days prior to the beginning of the paralysis which is usually of sudden onset and is, many times, the first thing to attract the attention of the parent or caretaker. In infants it may be some time before the paralysis is noticed although, if looked for, is easily found. Within a few days after the onset of the paralysis, muscular atrophy begins which is quite rapid if allowed to proceed untreated.

The chronic type of poliomyelitis takes the form of progressive muscular atrophy and differing therein from the acute infantile type which usually is at its height when discovered. Any further changes in the acute type are improvement or contractures from muscle atrophy.

The acute type is to be differentiated from birth palsies, myelitis, meningitis, or injury.

The general management of these cases will require the best hygiene possible, rest in bed during the acute or febrile stage which

is from one to three weeks, a light, or better still, milk diet with regulated exercise after the third week. As to after-treatment, surgery is at times needed to prevent contractures or for nerve transplantation.

Drugs internally have but little influence upon the course of the disease for in infants and early life the damage is usually all done when the condition is first seen and any change is usually toward improvement. The same may be said of sub-dermal and intravenous medication. Strychnin arsenate in very small doses is at times useful to help build up general nerve tone and as a stomachic.

The modalities most useful are the general visible-light and actinic-ray treatments particularly during the acute stage, the slow and rapid sinusoidal currents, galvanism, and massage after the third week.

Physiotherapy offers the most aid after the acute stage has passed and probably the most during the acute stage provided the child is so situated that the apparatus could be used at once. For the early treatment, general visible light and actinic rays are undoubtedly the best physiotherapeutic measure. The inflammatory stage lasts about two or three weeks. For the condition existing after this period, especially if the paralysis is extensive, both visible light and actinic rays should be used for their general metabolic effect, while for the paralysis slow sinusoidal current is without doubt the best means to use to-day. At times the interrupted galvanic current is of decided value particularly for older children. I say particularly for older children for the reason that the shock produced by the interruption of the galvanic current is often so severe that young children will not tolerate it. Occasionally the straight galvanic current will be of use for its ionization effect and infrequently the faradic, but this current is now largely replaced by the sinusoidal currents with distinct advantage.

The rapid sinusoidal current is often of value in these conditions for the stimulation of the nerve supply. However, what we have found most valuable is the combined rapid and slow sinusoidal currents given at the same time. These usually go under the name of the super-imposed wave currents. The slow sinusoidal contracts the muscles while the rapid sinusoidal stimulates the nerve supply. The sinusoidal treatments should be given with one electrode over the spine above the lesion, the other over the muscle or muscles involved. See that the electrodes are well moistened when in use. The frequency of the contractions should be from ten to thirty per minute. The milliamperage should be from five to fifty or enough to produce definite muscle contraction. The treatment should not be continued for over ten minutes otherwise the muscles will be overfatigued. These treatments should be given daily until there

is a definite improvement, then thrice or twice weekly and they must be persisted in for months.

While giving this treatment the child, if old enough, should be instructed to use its willpower to contract the muscles that are being contracted by the current and this can be readily accomplished in children of four or five years of age or older if a little patience is used. If the treatment is made a game, the child will usually enter into it with enthusiasm and will aid materially in the re-education of the involved muscles.

It is certain that the destroyed nerve centers cannot be rebuilt but the collateral nerve supply can be made adequate to take care of the needs of the various muscles in the vast majority of cases and in this effort the sinusoidal currents are a distinct aid.

Exercises of a selective type to aid in the rebuilding of the atrophied muscles are of the utmost value and with children these must be made into a game in which the child is the chief actor. At times, a special apparatus must be made to suit the individual or the area involved.

The earlier the treatment is begun the better the results and to date no harm has been seen from starting the physiotherapeutic treatment as early as the third week for its restorative effects, and cases can be benefited that have been allowed to go for five, six, or seven or more years without anything particular being done, and if this is true how much more then can we do if we begin the treatment at the end of the first month before very much atrophy has taken place? These cases will often tax your ingenuity to devise ways and means of overcoming their difficulties. If treatment is begun early and given persistently it will seldom be necessary to use splints or casts to prevent deformities.

Massage and hydrotherapy are of immense value in treating this condition and should be used daily and continued for months or years if necessary.

Complications affecting this disease will usually be found in the central nervous system or the brain tissues themselves. These, however, are not found in the average isolated case nor in most epidemics, although meningitis is a complication in some isolated epidemics.

In rare instances or epidemics of acute poliomyelitis there will be sufficient cerebral involvement to produce atrophy of muscles supplied by cranial nerves but this is extremely rare.

The average length of time required for treating a case of infantile paralysis will vary from three months to two or more years and should be persisted in as long as there is definite improvement.

After the acute symptoms have passed, the prognosis is good as to life but only favorable as to complete recovery from the

paralysis. While many cases will have serviceable limbs, most of them if examined carefully will show permanent disability. Notwithstanding this, it is surprising even to physiotherapists the number of muscles that will regain their normal activity.

Progressive Muscular Atrophy.

Progressive muscular atrophy is seldom classed with poliomyelitis anterior acuta but as its pathology is so nearly the same we are so classing it here.

The chronic type is progressive until death relieves the individual. The muscles of the hand are usually the first to show atrophy, this will be progressive and advance up the forearm and arm until finally the shoulder muscles are reached.

The pathology is a gradual destruction of the anterior horns of the spinal cord.

In chronic types, fibrillation is the cardinal symptom. This can be seen early if watched for patiently. Later it is continuous day and night, seldom allowing the patient a sufficient amount of rest, thus being extremely nerve racking to himself and attendant. No other disease gives the same type of fibrillation as progressive muscular atrophy and once seen it is always remembered. This fibrillation and the accompanying paralysis spread from one spot to many, then over the entire body and always to a fatal termination regardless of treatment.

The diagnosis is almost invariably made upon two symptoms, fibrillation and paralysis and it must be differentiated from injuries such as nerve traumatism, fractures, and dislocations, also from neuro-syphilis.

Case 524. Male, age 28. His condition was first noticed February, 1922, and it had grown rapidly worse in June, 1922. At the time of his first visit to our office, October 23, 1922, there was marked atrophy of the muscles of the left hand with continuous fibrillations about both shoulders and both arms, with slight fibrillations of the leg muscles and a gradual lessening of normal muscle contraction. His condition was fully explained to him and he was advised to seek further medical examination and analyses of his condition before beginning treatment, which he did. As none of these cases have ever been known to get well, the only promise made to him was a possible temporary improvement in his general health and a hope of retardation of the disease.

He was given general visible-light and actinic-ray treatments every second day for fifteen months. His weight when he came to us was 134 pounds. A year later his weight was 152 pounds and he had been quite free from fibrillations a good part of this time. He then began to have an increased amount of fibrillations and increased atrophying about the lower extremities and six months later was not able to come to the office for treatment.

DIAGNOSIS: Progressive Muscular Atrophy.

Proctitis.

Proctitis is an inflammation of the rectum divided into two types, acute and chronic.

The etiology of both types is the same, which is anything that will produce an inflammation of the lower bowel, such as hemorrhoids, fistulae, tumors within the pelvis, chronic infection of the colon or sigmoid, gonorrhea, syphilis, or tuberculosis, and last and most important, malignancy.

The pathology necessarily varies with the etiology and is anything from a slight inflammation of the mucous membrane to the destructive action of a malignancy. It is not contagious or infectious unless due to syphilis or gonorrhea or some other bacteriological disease.

There is no definite blood picture, but in the chronic cases there is usually a secondary anemia, which is more or less marked according to the severity of the case.

The cardinal symptom of all cases is a deepening of the color of the rectal mucous membrane, which may be anywhere from a light hypermia to purple in color. In these cases there will be a sense of deep fullness (due to congestion) and possibly a sharp pain particularly on defecation. In chronic cases, there may be no subjective symptoms or there may be constant pain or distress. All of these cases have mucus as one of the constituents of the bowel movement the same as colitis, and if there is ulceration there will be pus and blood either occult or macroscopic.

The diagnosis of a case of proctitis will be easy if the rectum is examined through a proctoscope or sigmoidoscope, thus learning by direct inspection that the gut is inflamed and that the mucus secretion is abnormal. Magnification will aid in determining the local condition. The case must now be differentiated according to its etiology, if one is to hope for definite results in the treatment of proctitis. Do not forget that ninety per cent of the cancers of the lower bowel are diagnosed as hemorrhoids for months before a correct diagnosis is made.

The general management of these cases will depend largely upon the severity of the pain and discomfort experienced by the patient.

While there is no necessity of putting these cases to bed, their exercise should be restricted, their diet should be light and digestible with a minimum of residue. The bowels should be kept loose enough to clean out the lower bowel every twenty-four hours. Surgical treatment is demanded if there are neoplasms, either benign or malignant. Drugs internally have a place in the treatment of proctitis but as a rule drugs locally are most advantageous. These are powdering the rectal wall with calomel, the use of a five to twenty per cent solution of fluid extract of *krameria* injected into the bowel as a retention enema, or the use of mild non-irritating

antiseptics. These are given with little trouble when the patient is in the genu-pectoral position.

Physiotherapy offers much for these cases. The milder ones are best treated with actinic rays through a proctoscope or short sigmoidoscope using the water-cooled lamp for periods of one or two minutes. The d'Arsonval current used as a destructive agent is invaluable either in the treatment of small neoplastic growths, benign or malignant, or for tubercular ulceration. For the tubercular ulceration, the actinic rays are usually our best physiotherapeutic modality and should always be associated with any other treatment. Syphilitic ulceration should be treated intravenously or by inunction and for the more acute cases, arsphenamine and mercury are the most active. For the tertiary cases, use sodium iodide, potassium iodide, mercury or arsenic. These are most effective if given intravenously. One of the most common complications of this disease will be strictures following the healing of any ulceration. These may be slight and cause no inconvenience or they may contract down to a very small opening not larger than a lead pencil and interfere with proper defecation. Heat bougies are the most effective method of treating the strictures.

The length of time these cases will require treatment will depend upon the etiological factor involved and is anywhere from a few days or a few months for the benign case, to the length of the patient's life for the advanced malignant ones.

The prognosis is good in the benign cases and is usually fatal in the malignant. Peri-proctitis is a complication which must be watched for because of the liability to abscess formation in either ischiorectal fossa. If this occurs, it should be drained surgically then treated with actinic rays both inside the bowel and locally over the fossa. These cases should also receive general visible-light and actinic-ray treatments for their constitutional effect.

Prostatitis.

Prostatitis may be either acute or chronic. Of the acute type we have the follicular, in which only the follicles of the prostate are involved, or the parenchymatous in which the whole gland partakes of the inflammation.

The etiology of both of these types is, in eighty per cent of the cases, due to a posterior urethritis of gonorrheal etiology. The bacteria spreads from the posterior urethra to the follicles and from them into the gland substance. Occasionally it is due to injury and then most frequently to rough or over instrumentation. Occasionally it is due to kidney or bladder calculi or to chronic congestion caused by anything which will congest the pelvis as hemorrhoids, constipation, etc. It may have its origin in a cystitis.

Its etiology is most invariably a bacteriology of an infective character.

The pathology is first congestion and surface inflammation, later inflammation of the entire gland, with abscess formation or resolution and some fibrosis or hypertrophy. If the urine first passed is examined, it will be found cloudy, while that following will be found to be clear, if the case is one of prostatitis, while if the case is one of cystitis the urine in both instances will be found cloudy.

There are no cardinal symptoms pathognomonic of prostatitis. If there is pain or sense of fulness in the region of the prostate, together with tenseness, especially at the end of urination, posterior urethritis or prostatitis may be suspected. Chronic cases are usually associated with parenchymatous hypertrophy of the prostate, while the follicular type is usually acute. If there is a retained urine, both types are associated with a chronic cystitis.

While prostatic hypertrophies are usually found beyond the age of 50, they may occur at any age and may have as their etiology a chronic prostatitis, particularly so in early adult life.

One of the usual symptoms of prostatitis is small drops of mucopurulent pus which can be obtained by prostatic massage, which usually goes under the name of gleet. There is often some pain in the sacral region, although this occurs with any inflammation in the pelvis.

Prostatitis must be differentiated from the straight posterior urethritis and inflammation of Cowper's gland, internal hemorrhoids, infection and abscess formation in the ischiorectal fossa, colitis, cystitis, and bladder calculi, and when occurring late in life must be differentiated from carcinoma of the prostate or rectum. Abscess may occur and complicate malignancies in this region.

In general management these cases will require a careful hygiene, a limited exercise, or if the symptoms are very acute and considerable pain, rest in bed, a light diet, the bowels kept free and the rectum empty. Surgery is not called for unless there is abscess formation. Drugs internally for the acute types as belladonna, ferrum phos., or aconite may be used for their sedative action; they are of little value for the chronic types. Occasionally an autogenous bacterin will be of value given subdermally. Intravenously sodium iodide 32 grains, and guaiacol $\frac{3}{4}$ of a grain give good results. Locally, drugs are used only for the relief of pain and congestion. This in the form of a belladonna and opium suppository.

Physiotherapy probably offers more than any other mode of treatment for these cases in the form of actinic rays through the proctoscope, covering first the seminal vesicles, second the upper portion of the prostate, and last the lower portion of the prostate, each area being treated for about one or two minutes only. Treatments should be given daily until active symptoms subside then twice a week. General visible-light and actinic-ray treatments

should be given at the same time. Occasionally diathermy with one applicator in the bowel, as large as can be introduced without pain, the other over the abdomen, will give almost immediate relief. This treatment applies alike to acute and chronic prostatitis, vesiculitis, and posterior urethritis. A minimum of thirty minutes with a milliamperage of 300 to 1000 should be given daily to weekly.

If as a complication there is a hypertrophy of the prostate, which is simple in type and with which there is an accompanying chronic cystitis with retention of urine, the same treatment will be found of value.

The average length of time these cases will require treatment is from a few days to a few weeks.

The prognosis is always good as to life and usually as to function.

Accompanying strictures are best treated by the use of infra-red bougies or the heat bougies rather than steel dilators and care should be taken with their use to cause the least possible amount of traumatism.

Both infra-red and the heat-bougie treatments soften the strictures, aid in the destruction of bacteria, cause a minimum of traumatism, and accomplish more in a half dozen treatments than steel dilatation will in months.

Case No. 0100. Male, age 57. His bladder control had grown so bad that, when Nature called, he would lose a part of its contents before he could get into the adjoining room. He was up every hour of the night.

Actinic rays were begun in October, 1917, and continued, as follows:

DATE	ACTINIC RAYS	PROSTATIC MASSAGE	CLINICAL FINDINGS
	Water-cooled Lamp	Duration of Treatment	
1917	Duration of Treatment	Duration of Treatment	
Oct. 12	10 min.	4 min.	Slight control.
Oct. 13	6 min.	2 min.	
Oct. 19	10 min.	2 min.	
Oct. 24	10 min.	3 min.	Better control.
Oct. 26	10 min.	3 min.	
Oct. 30	10 min.	3 min.	
Nov. 5	10 min.	3 min.	Control for two hours. Improved. Three times at night. Bladder held eight ounces. Can go for four hours. Bladder held ten ounces.
Nov. 9	10 min.	3 min.	
Nov. 15	10 min.	3 min.	
Nov. 28	10 min.	3 min.	
Dec. 10	10 min.	3 min.	
Dec. 21	10 min.	3 min.	
1918			
Jan. 8	10 min.	3 min.	Bladder control nearly normal.

DIAGNOSIS: Prostatitis, chronic.

Case No. 0101. Male, age 45. Had had prostatic irritation for twenty years, which had kept him irritable and interfered with proper rest at night.

Actinic-ray treatments, through our special proctoscope, as stated below:

DATE	ACTINIC RAYS	PROSTATIC MASSAGE	CLINICAL FINDINGS
1917	Water-cooled Lamp	Duration of Treatment	
June 10	4 min.	2 min.	No improvement. Less nervous.
June 12	5 min.	3 min.	
June 14	7 min.	4 min.	
June 16	7 min.	4 min.	Much improved. Sleeping improved.
July 5	8 min.	4 min.	
July 10	8 min.	4 min.	
July 16	8 min.	4 min.	One bad night. Feeling better. Sleeping splendidly. Very much improved. Feeling fine. Feeling fine.
July 26	10 min.	4 min.	
Aug. 6	10 min.	4 min.	
Aug. 21	10 min.	4 min.	
Aug. 28	10 min.	4 min.	
Sept. 5	10 min.	4 min.	
Sept. 18	10 min.	4 min.	
Sept. 28	10 min.	4 min.	

DIAGNOSIS: Prostatitis, chronic with Vesiculitis.

Prostatic Hypertrophy.

Prostatic hypertrophy is a condition rather than a disease although it is a symptom of several. In type, it may be either acute or chronic. The acute type is associated with acute prostatic infections which may be accompanied by abscess formation. The chronic type is associated with chronic prostatitis, malignancy, tuberculosis or fibrosis.

Etiology. In the majority of cases a simple hypertrophy is concurrent with advancing age rather than from acute disease. Either one or both lateral lobes may be enlarged or the central lobe alone may increase in size until it causes urethral obstruction.

The pathology is that of simple parenchymatous hypertrophy with fibrosis or true fibroid tumor formation and malignancies either carcinoma or sarcoma, seldom the latter. Simple hypertrophies are usually soft but not doughy to palpation while the fibroid type is hard, globular, and about equally enlarged throughout the lobe. The malignant hypertrophies are usually nodular, extremely hard (almost stony hardness), with an irregular outline and may be in one or both lobes at the same time, usually one. If the malignant disease has progressed for some months, the seminal vesicles will be found to be flattened, hardened, nodular as is the prostate gland itself. In size it may be anywhere from a little larger than normal to an enlargement that will fill the pelvis.

The tubercular hypertrophy is usually associated with tuberculosis of the testicles and is metastatic from them. In these cases the prostate is large, nodular like the malignant but does not have its stony hardness. The seminal vesicles are enlarged, nodular, and adherent as in the malignant cases but again they do not have the stony hardness of the malignancies. However, as one does not find the malignancies associated with tuberculosis of the prostate and one does find tuberculosis of the testicle as its antecedent, there should be little difficulty in differentiating them.

The cardinal symptom of hypertrophy is the enlargement which can be detected by digital examination, unless the enlargement is confined to the central lobe, when it will be necessary to use the cystoscope. The differential diagnosis has already been given.

The general management of the case will require careful study. Exercise should be regulated. The obese cases are benefited by exercise provided it does not increase pain. Rest in bed will be required in acute septic cases and for debilitated individuals. The diet should be light and non-stimulating, and the rectum be kept empty. As soon as the enlargement becomes sufficient to cause pressure upon the urethra, retention will be one of the cardinal symptoms and the retained urine may be any quantity from two up to twenty ounces or more. If it is above five or six ounces, it is usually necessary to draw the urine at least once a day by catheter, which of course means that in a short time the bladder will become infected, producing a chronic cystitis as a complication to the prostatitis.

Surgery is called for in some of these cases, but physiotherapy should be given a thorough trial before resorting to operative procedures. Prostatectomy does not produce impotency. The physiotherapeutic modalities useful are actinic rays, diathermy, heat bougies, infra-red rays, X-rays, and radium.

Radium is best used in the form of steel needle applicators of ten or twelve milligrams each. These long steel needles are inserted through the perineum without cutting, then passed along the outside of the rectum until the gland is reached, then inserted as nearly as possible into its center, provided it is not over two inches in diameter. If larger, the needles are to be inserted in one-quarter and the treatment repeated in two or three weeks until all of the prostatic gland has been brought under the influence of the gamma rays. The time should be six to twelve hours for each application. Radium is most useful in fibroid and malignant cases but should not be used in the presence of infection.

X-ray treatments must be given with either two or four portals of entry, the number depending upon the size of the individual and the size of the growth to be influenced.

Infra-red rays should be given by a rectal applicator if this is possible without causing pain, otherwise through the pelvis,

using the applicator anteriorly over the pubes or posteriorly over the sacrum for one-half to six hours daily. Heat bougies, either flexible or metal, give very decided relief in many cases of infective prostatitis. Infra-red rays are of no benefit in fibroid cases, and in malignant cases give slight relief from pain only. Diathermy may be used in all classes of cases but is most useful for chronic infective cases, particularly when they are of gonorrheal origin.

The actinic rays from the water-cooled lamp will benefit a larger percentage of all cases of prostatic hypertrophy than any of the other physical modalities but are best for the simple hypertrophy. They do not affect either the fibroid or the malignant hypertrophy which must be treated with radium, X-ray, or by operation. For the tubercular enlargement, nothing equals the actinic rays. These should be given as visible-light and actinic-ray treatments and as local treatments with the water-cooled lamp. These treatments should be daily at first then two or three times a week. Of course, one will treat the involved testicle at the same time. (See tuberculosis of the testicle).

When giving these actinic-ray treatments with the water-cooled lamp, a proctoscope is used to reach the prostate and surrounding tissues. Insert it to full depth to ray the seminal vesicles and bladder then withdraw it about one-third for the upper part of the prostate, then about a second third for the lower portion always keeping above the external sphincter in order not to blister its mucous membrane. In this way all of the tissues are rayed. Treatment should be given from one to two minutes for each area, seldom more. These treatments should be given daily until there is definite relief and then about twice a week and must be continued for several weeks or months provided some relief is obtained in the first five treatments, otherwise their continued use is not warranted.

The prognosis of a simple hypertrophy is good and the same for a fibroid hypertrophy if radium is used. For malignant prostate, unless seen very early, no treatment is successful although radium often gives the individual one, two, or more years of comparative freedom of symptoms.

As soon as metastasis occurs, nothing but palliative results can be expected. If the middle lobe alone is involved, the application of the d'Arsonval current through the cystoscope to either the base or sides of the lobe, slightly coagulating enough to produce contraction, gives definite relief without resorting to cutting operations. This measure must be considered a surgical procedure and it must be done under a general anesthetic. "Twilight sleep" or gas is the best anesthesia for this work or they may be combined. Radium has been successfully used for the middle lobe. Use it the same as for the fibroid hypertrophy. At times it is best to treat these cases with two or more of the modalities given.

Case No. 335. Male, age 71. Came for treatment February 17, 1922, complaining of having to get up several times at night to empty his bladder. There was no pain nor impediment during the evacuation.

Rectal examination disclosed an enlarged prostate which was soft but not especially sensitive to pressure.

His treatments were with the water-cooled actinic-ray lamp. The rays were passed through a proctoscope into the rectum for two minutes each, over three areas. Six such treatments were given five days apart and after the fifth treatment he was able to sleep throughout the night.

DIAGNOSIS: Prostatic Hypertrophy.

Prostatic Cancer.

Case No. 715. Male, age 41. Came to us April 9, 1924. For the past year had been having pain in the pelvis, which for several months had been fairly constant. Lately has had pain when urinating which increased as the bladder emptied. This has disturbed his sleep. He had lost weight for the past four months. Cystoscopic examination showed nodule in middle lobe of prostate and palpation revealed several very hard nodules in both lateral lobes.

Two radium needles carrying twelve and one-half milligrams each were inserted into the lateral lobes through the perineum and left in place for twelve hours. There was some relief of pain in three days, at which time he returned home.

July 15, 1924, he had no symptoms and his general condition was good.

On August 27, 1924, palpation showed the prostate gland to be normal in size and free from nodules.

The gland was apparently normal when examined January 16, 1925. There were no symptoms and he had gained 23 lbs. in weight.

He was re-examined March, 1926, and the prostate was found to be in a normal condition with no signs or symptoms of recurrence.

DIAGNOSIS: Prostatic Cancer.

Pruritis Ani and Vulvae.

Pruritis vulvae may be described by the one word, itching, which is the one subjective symptom. This may be intermittent or continuous. In the early stages there are frequent intermissions. In the later stages, when there are objective skin changes, the itching may be continuous although more intense at night from the warmth of the bed, which causes maceration. It may be confined entirely about the anal opening or about the vulva or it may spread up on to the lower abdomen and down on to the thighs; almost invariably it spreads to the buttocks.

The objective symptoms are usually scratch marks except the cases which have persisted for years, when the skin may become thickened and ulcerated. These cases are not to be confounded in any way with a general pruritis or bodily itching, which occurs to so many people in winter particularly after bathing. General pruritis is also associated with constitutional diseases as diabetes mellitus.

The etiology of a case of pruritis may be varied, and therefore it behooves the diagnostician to look well into these cases before starting treatment. It must be remembered that some cases are wholly psychic, while others are accompaniments of diabetes mellitus, nephritis, uterine disorders with vaginal discharges, vaginitis, and proctitis. In the two latter cases it is the irritating discharge about the orifices which causes the itching. Ovarian tumors or pregnancy will impair the circulation about these parts and is also an etiological factor. Hemorrhoids, fistulae or fissures, with their well known sentinel pile, are common etiological factors. Keeping these parts overheated and macerated starts many a case of pruritis ani or vulva. Pediculosis pubis, eczema, and scabies all have a prominent part in the etiology of pruritis, therefore it is necessary first to diagnose the etiological factor, then treat it along with the symptom pruritis.

The general management of these cases will naturally depend upon the etiological factor, but it may be said that the cleanliness of these parts is of first importance. If due to scabies or eczema, soap and water should not be used but rather a 20% sulphur ointment should be rubbed in twice daily for a week, then the skin cleansed with soap and water. This bath should be followed by the application of a 10% to 20% solution of oleum terebinthinae in oleum olivae. The treatment of these cases naturally sums itself up into treatment of the etiological factor, if this is at all possible. Drugs by any other method than local seem to have very little, if any, effect upon the disease. For the pruritis of diabetes mellitus, nothing equals the saturated solution of magnesium sulphate, either as a wash or a wet dressing. Where proctitis, vaginitis, cervicitis, or endocervicitis exists, the treatment of these conditions is usually sufficient to stop the itching. Opiates should be avoided by all means because of their habit-producing tendencies.

Actinic rays are the best treatment for the vaginal discharge and proctitis, as well as for the local treatment of the pruritis itself. Hemorrhoids must be removed; constipation or diarrhea corrected. The pressure of tumors must be relieved. When occurring during pregnancy, the case resolves itself with the termination of the pregnant state. Externally and locally for the pruritis itself, nothing equals the actinic rays from the water-cooled lamp, which should be used at a distance of about one-half inch for a period from one-half to four or five minutes over the entire area,

the latter time being used if the skin is thickened and ulcerated. A heavy blistering will many times stop the itching and the patient is grateful for the actinic-ray burn. Actinic-ray treatments should be given daily until there is definite improvement, then three times a week. The air-cooled actinic-ray lamp is not sufficient for these cases.

Surgery has been used for these conditions, but as a rule it is not successful. X-ray and radium are at times useful, but must be used with a great deal of caution to prevent gamma-ray dermatitis. In some cases after the pruritis is relieved, the habit of scratching must be overcome. In cases that have been running over a period of years and the skin has become thickened, it may take six months to a year to entirely relieve the condition, but once improvement has started, treatment must be persisted in or recurrence is certain. A more grateful patient is hard to find than he who is relieved of his pruritis ani or she of her pruritis vulvae.

Case No. 351. Female, age 59. Came to us October 24, 1917, with itching about the anus, which began in May, 1917, and had grown steadily worse until it was almost unbearable. There was some vaginal leukorrhea. Actinic-ray treatments were as follows: vaginal treatments were given through a bivalve speculum using a proctoscope to avoid burning the vulva. The water-cooled lamp was used for a period of two minutes followed by a local treatment with the water-cooled lamp held one inch from the anus for a period of two minutes. These treatments were given every third day until eight treatments had been given with complete relief.

DIAGNOSIS: Pruritis Ani.

Case No. 29. Female, age 35. Had a pruritis vulvae of two years' standing which had grown rapidly worse during the past six months; slight abrasions of skin over pubes and labium majus from scratching.

A one and one-half minute treatment gave complete relief for one night; a second treatment of two minutes gave some relief; while the third treatment of four minutes, though it blistered badly, gave almost complete relief from the itching. The water-cooled lamp was used in this case. Slight itching has returned at times, but a mild non-blistering raying readily controlled it. No other treatment internally or externally was used.

DIAGNOSIS: Pruritis Vulvae.

Psoriasis.

Psoriasis is a chronic skin disorder, the etiology of which is unknown, but probably has been speculated with as much or more than any other disease affecting the human family.

From results of our own treatment we would say that it was a change in blood chemistry, which in turn affects the chemistry of the cells of the skin.

The pathology is a superficial inflammation of the skin superimposed by a silvery or pearly white scale which has the appearance of being stuck on. As these scales increase in size, they tend to drop off and new ones to reform, thus the disease goes on indefinitely. It may affect any portion of the body, but is most usually found upon the trunk or arms; however, it is frequently found in the hair and on the legs but seldom on the face.

There is no laboratory finding which will diagnose the condition psoriasis.

The diagnosis depends upon the finding of the pearly white scales, which may be as small as a pinhead or as large as a quarter; usually they are about the size of a ten-cent piece in well developed cases.

The cardinal symptom is wholly objective,—that of the scale itself. Seldom is there itching or any other accompanying symptoms.

The general management of these cases is to keep the patient in the best possible general health. There is no surgical treatment. Drugs seem to limit themselves to two general classes, calcium and the salicylates. The best form of calcium that the writer has found is that of sea plasma, which is injected into the muscles in doses of from five to fifty cc. twice a week. Some cases, however, do not respond to this and in these we use salicylate of soda in doses of about 20 grains intravenously two or three times a week.

The best treatment we have found for these cases and which we always use in conjunction with any drug therapy is physiotherapy in the form of general visible-light and actinic-ray treatments with intensification over the areas, at least over the larger areas with the water-cooled lamp at a distance of about one-half inch for one to three minutes, or a sufficient time to blister.

There are no complications and the average length of time these cases require treatment will be from a few weeks to months as many of them have run for years before they come into your hands for treatment. It is not to be expected that they can be relieved at once, but many cases show improvement in the first few treatments.

The prognosis is good as to life but there is a probability of recurrence. As soon as recurrence does occur, actinic-ray treatments should be started as well as any drug therapy which was found to be of any benefit in the original treatment of the case. X-rays have been used in the treatment of these cases but unless used with a great deal of caution, burns are likely to occur and the case to be in a worse condition than it would have been had it not been treated at all.

Case No. 311. Female, age 40. Came for treatment August 26, 1924, for an eruption which she had had despite medical treatment for the past ten years. The eruption consisted of large areas

several inches in circumference which were coalesced, smaller areas each covered with a pearly white scale which had the appearance of being "stuck on." There was some itching about the eruption. The diseased areas were mostly on the body, some in the hair, and others about the elbows and knees.

Her treatments were general visible light and actinic rays, with extra actinic-ray radiation of the diseased areas with the water-cooled lamp held at a distance of one inch. The extra time was one or two minutes for each area. There was improvement, after the sixth treatment and the scaling had stopped and most of the redness had disappeared after the twenty-fifth treatment.

DIAGNOSIS: Psoriasis.

Pyelitis.

Under the head of pyelitis will be included all pus-producing diseases of the kidneys.

These have as their etiological factors, bacterial infections, which may have extended upward from the urethra and bladder through the ureter into the pelvis of the kidney and thence into the kidney substance. They may follow gonorrheal, streptococcic, or staphylococcic infection, operative measures or instrumental methods of examination, irritant drugs and chemicals either given internally or used locally. Tubercle bacilli frequently find lodgment within the kidney or the disease may extend upward from tubercular bladders through the ureters. It may be a blood-born infection from any of the acute eruptive fevers or from an acute infectious disease. Calculi produce an acute nephritis and sometimes with it a pyelitis or pyonephrosis.

The pathology is that of an inflammation of the lining of the pelvis of the kidney or of the kidney substance itself. It may be anything from a simple inflammation to that of total destruction with pus formation not only within the pelvis of the kidney but within the kidney substance.

The laboratory findings will be leucocytes, epithelium, blood either occult or macroscopic, and usually numerous casts. There is no cardinal symptom of a pyelitis unless it is the urinary findings after catheterization of the pelvis of both kidneys and the specimens examined separately.

The usual symptoms of the chronic cases are very mild and may not be referred to the kidneys. When pyelitis is associated with calculi, pain is very intense, especially upon pressure or percussion over the kidney. This pain radiates from the kidney to the ureter, to the bladder, or frequently into the groin and pubic region. Should the inflammation become chronic, atrophy of the kidney is most sure to follow, which in turn may be followed by uremia. One or both kidneys may be involved. Fortunately in most cases the lesion is unilateral.

Diagnosis of pyelitis is often difficult and impossible without ureteral catheterization and pyelography. This should always be done before any operative measures are taken to ascertain which kidney is involved, or if both are involved; also to ascertain if the function of the remaining kidney is normal, otherwise it will be necessary to dispense with all operative measures.

The general management of these cases will depend upon the severity of the lesion and the acuteness of the onset of the case, also whether or not it is associated with an infectious disease. Most of these cases will require at least a limited exercise, if not total rest in bed. Milder cases may be able to go about their daily occupation provided it is not too strenuous. The bowels should be regulated so as to throw the least amount of work upon the kidneys, thus relieving them as much as possible.

In the treatment of this condition, surgery plays an important part and must be done only after weighing all the factors in the case and is interdicted if both kidneys are alike involved. If only one kidney is involved and the other is functioning normally, surgery offers the best treatment. Drugs internally have but little to offer and the same may be said of those subdermally. Intravenously, various drugs have been used with a modicum of success. Locally and externally, drugs are of little if any benefit and only as a counter-irritant. If used in the pelvis of the kidney through the ureters, the silver salts are at times of benefit.

Physiotherapy offers a decided relief in these cases usually in the form of general visible-light and actinic-ray treatments.

Diathermy may be used with benefit to some cases. One electrode should be placed over the kidney at the back and the other directly opposite the kidney region in front. The composition-metal electrodes should be about 4 by 5 inches each, placed in absolute contact with the skin. The minimum of time should be thirty minutes and the treatments should be given daily to weekly. The milliamperage 500 to 1500.

As pyelitis is a complication of other diseases, it has few complications that are to be taken into consideration when studying the etiology.

The average length of time these cases will require treatment will depend upon the severity of the lesion and whether one or both kidneys are involved. If one kidney is involved and can be removed surgically or properly drained, that may be the end of the trouble. On the other hand, if both kidneys are involved with a low grade infective process it probably will continue for the remainder of the individual's life.

The prognosis, therefore, depends upon the severity of the lesion and whether or not one or both kidneys are involved. These are all serious cases.

Pyosalpinx.

Pyosalpinx is a definite inflammation of the fallopian tubes due to infection. In about ninety per cent of the cases the bacteriology is Neisserian and the other ten per cent is spread among the various bacteria in about the following order—streptococci, staphylococci, tubercle bacilli, colon bacilli, and very infrequently actinomycosis.

In ninety per cent of the cases the bacillus of Neisser gains entrance through the uterus from a vaginitis in the following order: an endocervicitis, a metritis, thence along the mucous membrane to the tubes, where the fimbriated extremity is sealed first, and the uterine extremity last, thus producing definite abscess formation in the tubes constituting the disease known as pyosalpinx.

The pathology is one of tubal inflammation with edema and followed by pus formation. If due to other bacteria than gonococci, the fimbriated extremity is seldom sealed, and a pelvic or a general peritonitis usually coexists, while with the gonococcic infection, general peritonitis seldom coexists. A localized peritonitis or pelvic cellulitis is a frequent accompaniment.

The blood picture is a secondary anemia due to infection. Other-laboratory findings are the infecting organisms found by smear or culture.

If the etiological factor is gonococci, spirochetes, or active actinomycosis, the disease is infectious and contagious; otherwise not.

The cardinal symptom of pyosalpinx is pain within the pelvis and is made worse by movement or pressure or by the appearance of the monthly period; in fact, anything that will congest the pelvic tissues. These pain symptoms may spread throughout the abdomen, but by careful palpation the diseased area may be outlined. If possible, a definite diagnosis of the bacteriology involved should be made before treatment is begun thus eliminating waste of time and treatment.

Differential diagnosis will lie between the etiological factors already mentioned, appendicitis, which is unilateral, ovaritis which may accompany peritonitis from other causes, cystitis, and cystic or fibroid tumor formations.

The general management of these cases will depend somewhat upon the stage at which the case is seen, the severity of the symptoms, and the extent of the pathology. Many of these cases go about their usual occupations without restriction. Exercise should be interdicted, although absolute rest in bed is not essential unless there is a large amount of pathology with peritonitis and high temperature. The diet should be light and the lower bowels kept free from fecal matter by saline cathartics in moderate doses or small doses of castor oil. Enemas may be used and one of the best

is magnesium sulphate, one ounce in one-half pint of water, used as a retention enema.

In an early stage of a gonorrheal salpingitis, surgery is seldom indicated. Tubal sterilization occurs in from six weeks to three months, after which laparotomy is a safe procedure. If abscess forms within the culdesac or in the broad ligaments, it must be drained through the vagina.

Drugs have but little effect upon a gonorrheal salpingitis. Small doses of sodium iodide and guaiacol may be used intravenously. Locally, packs saturated with magnesium sulphate (saturated solution 25%) in glycerin introduced into the vagina on cotton or gauze to the extent of three or four drams for its depleting and refrigerant effects will act as a sedative and is a grateful treatment in these cases.

Physiotherapy offers us the best mode of treating these cases, except such as demand operative interference. Physiotherapy in the form of galvanism will be found to limit the inflammation and to relieve pain symptoms. Use a copper-ball electrode, covered with cotton wet with a 5% copper-sulphate solution, in the vagina and place the indifferent electrode over the abdomen, using ten to thirty milliamperes of current for fifteen to thirty minutes.

However, actinic rays from the water-cooled lamp for local treatment given through a bivalve speculum give the quickest relief and often bring a high temperature to normal within a few days. In addition to this local treatment to the vagina, general visible-light and actinic-ray treatments should be given.

See Gonorrhea and Cellulitis for further treatment.

The complications are usually peritonitis, either local or general, regardless of the etiological factors, but it is more pronounced with a streptococcic or tubercular infection than with a gonorrheal.

The average length of time these cases require treatment is from a few weeks to months.

The prognosis is usually good as to life, but the disease renders the individual sterile in the vast majority of cases unless treatment is started early, thus limiting the damage to the tissues. Once the fimbriated extremity is sealed, sterility is permanent and this is the cause of most of the one-child marriages. The infection frequently takes place soon after marriage, although as a rule not sufficiently early to stop the first pregnancy. Tubal infection, with its consequent strictures, is one of the causes of the ectopic pregnancies.

The prognosis is usually good as to life, but seldom does a woman regain her good health.

Should a blood vessel rupture into an inflamed or infected tube, the condition is known as hematosalpinx. On the other hand, the late stage of a pyosalpinx is a hydrosalpinx, which follows the

sterilization of the pus. On the other hand, the pyosalpinx content may be absorbed and we have a condition known as obliterative salpingitis. These are all end results.

Case No. 191. Female, age 26. Came to use February 15, 1917, with a history of exposure December, 1916, and burning on urinating ever since. She now had pain in both ovarian regions, with a sense of weight throughout the pelvis. We gave her the following treatments:

DATE	ACTINIC RAYS		CLINICAL FINDINGS
	Water-cooled Lamp		
1917	Duration of Treatment	Distance from Patient	
Feb. 15	10 min.	2 in.	Considerable pain.
Feb. 16	12 min.	2 in.	Discharge yellow.
Feb. 22	12 min.	2 in.	Has been flowing; less pain.
Feb. 28	10 min.	2 in.	No pain.
Mar. 2	10 min.	2 in.	
Mar. 9	10 min.	2 in.	Discharge white.
Mar. 14	10 min.	2 in.	No pain; slight discharge.
Mar. 17	12 min.	2 in.	No pain or soreness.
Mar. 28	12 min.	2 in.	Very much improved.

DIAGNOSIS: Pyosalpinx.

Rachitis.

Rachitis is an osseous malnutrition usually occurring in infancy and early childhood up to six or seven years of age.

The usual etiology of these cases is unhygienic surroundings, deficient or incorrect feeding, insufficient sunlight and exercise, and defective ventilation. Most of these children are kept in the dark or away from the direct sunlight and are usually found in the crowded districts of large cities or manufacturing centers. Many of these cases are not diagnosed until the child begins to walk, which is months later than normal. Dentition is delayed.

Rachitis is our most common nutritional disease, however not in its advanced stage, but in its incipient stages, where the main symptoms are digestive disturbances either of the stomach or intestinal tract.

The predominating pathology is the deficiency of inorganic phosphorus and calcium. The calcium may be normal in the blood supply, but it is usually deficient in the bones and this may mean any bone in the body, although the long bones are most frequently affected followed closely by the skull and the vertebrae.

There is no bacteriology connected with the disease.

It has no definite blood picture, although it is frequently similar to the blood picture of the anemia of simple chlorosis.

The most characteristic symptom of rickets is the beading of the ribs (rachitic rosary), which in an undernourished child can frequently be seen as well as felt. This occurs about the earliest

of any symptom unless it be the general restlessness and irritability of the child, particularly when it is handled or moved. Following this the abdomen enlarges and there may be night sweats, particularly about the head, simulating tuberculosis. Pain is not a frequent symptom, although there is discomfort on handling. Craniotabes is common.

Deformity of the spine may be in any direction; likewise that of the legs. The muscles are hypotonic, which is one factor in the condition known as "pot belly." Endocrine dysfunctions play a part in the development of this disease, but their relations are not definitely known.

In diagnosis it must be differentiated from osteomyelitis; also from a decalcification which occurs in pregnant or nursing women. Rachitis, however, is almost invariably a disease of infancy and early childhood. It must also be differentiated from scurvy, tuberculosis, emaciation from improper feeding, infantile paralysis, and congenital syphilis.

The general management of these cases will be the best hygiene possible, a limited exercise, and then only in the open until there is some control of the disease, when graduated exercise should be insisted upon. Children who live much in the open and play in the sunshine seldom have rickets, even if their diet is rachitic producing.

Diet, however, plays the important part in the whole treatment. If the child is breast fed and the mother undernourished, it is usually wise to change the diet to cow's milk or better still to goat's milk; these modified to suit the individual's digestion and taste. These children almost invariably lack fat and should be supplied fat, as cod-liver oil, which probably is the best. Olive oil is a suitable substitute if the child cannot take cod-liver oil. If olive oil is used, it should be placed in a shallow dish and rayed for thirty minutes with the air-cooled quartz-mercury lamp at a distance of twenty-four inches. This will activate it and make it nearly equal to cod-liver oil and much more palatable. This is after the method of Professor H. Steenbock of the University of Wisconsin. The olive oil should be fed in such quantity as the stomach of the individual will tolerate. Milk may be radiated in the same way, but of course must be used before it sours.

If cod-liver oil cannot be taken by way of the stomach, it may be given by inunction and from one to two ounces rubbed in daily and it is surprising how quickly this alone will cause a change in the nutrition of these children. It improves their digestive ability so that other articles of diet, particularly fruit and vegetables, may quickly be added and many different vegetables and fruits are needed for the proper development of children. Where pure cod-liver oil cannot be taken, it can be diluted to a 95 per cent solution with chocolate. Bacon and pork, from which the salt has been removed, are excellent substitutes for cod-liver oil.

If cow's or goat's milk is used, it should be certified rather than pasteurized. Both contain greater percentages of magnesium than mother's milk. Milk for infants should be from cows or goats exposed daily to sunlight, or better still, they should be irradiated with quartz-mercury lamps. Cream and butter should be furnished in as large a quantity as the stomach of the individual child can handle. Less than one milligram of activated food substance is apparently sufficient to protect a child from rickets. (Hess.)

Beef juice, orange, lemon, prune, and tomato juice furnish a very important place in the diet of these children. Any undernourished child, even a few months old, will cry for tomato juice once it has had a taste of it, and we have never seen any harm come from feeding them a few teaspoonfuls a day.

Vitamins A and D are both found in egg-yolk which is a good food for the rachitic case. McCollum states that vitamin D is transmitted through the mother's milk, but it is not known at this time whether in sufficient quantity to protect the infant against rachitis.

Coarse ground whole wheat should be fed to the rachitic child as soon as it is old enough to digest it, which should be in the latter part of the first year. The wheat should be cooked in a double boiler for not less than four hours and it is better to cook it eight or more hours. Whole wheat aids materially in regulating the bowels and in supplying calcium, inorganic phosphorus, and vitamin E, which are necessary for proper growth. Hard whole wheat contains much more phosphorus than soft wheat. Calcium is not deposited in bones unless there is an optimal amount of phosphorus, even though the calcium intake is greater than the need. The average normal breast milk contains 32.6 mg. of calcium per 100 cc., while the average breast milk from mothers whose children had rickets was 27.5 mg. per 100 cc. The inorganic phosphorus should not be less than 4 mg. per 100 cc. of breast milk, which is about $\frac{4}{5}$ the normal average for blood serum. The normal content of calcium in the blood stream is between 10.5 and 11 mg. per 100 cc. of serum, while it may be as low as 5 mg. when associated with tetany. The normal inorganic phosphorus should be about 5 mg. per 100 cc. of blood serum. If the organic phosphorus is below 3 mg., the child probably has rachitis. For the first 20 years of life, the inorganic phosphorus content of the blood serum is about 5 mg. per 100 cc. of blood serum. After 20 years of age the average is about 3.75 throughout adult life.

Cod-liver oil and actinic rays are very active in the restoration of a subnormal phosphorus component and this in turn aids in the deposit of calcium in the various osseous structures. They provide something which is essential for normal cellular function.

Internally, small doses of calcium iodide, 1/1000 of a grain,

will be of definite benefit. Other beneficial calcium salts are calcarea carbonicum, calcarea phosphoricum, and at times ferrum phosphoricum in like doses, which may be increased to 1/100 of a grain three times a day.

Subdermally, sea plasma is of benefit, being given in from one to ten cc. intramuscularly two or three times weekly. Pure cod-liver oil is by all odds the best drug to be used and the best way to use it is by inunction. The only objection to its local use is its odor and staining qualities.

Physiotherapy offers much to these cases and principally in the visible-light and actinic-ray treatments.

The United States Bureau of Chemistry says: "Sunlight is in effect a suitable substitute for vitamin D in the cure of rachitis." Hess says: "Rickets can be prevented by daily exposures of fifteen minutes to sunlight, four minutes to arc light at a distance of three feet, or about two minutes to the rays of the quartz-mercury lamps."

Steenbock (1924) found that irradiation with actinic rays for ten minutes daily increased both the calcium and inorganic phosphorus content of the blood stream and this despite the absence from the food of fat soluble vitamins as found in cod-liver oil, butter fat, etc. Apparently cod-liver oil and actinic rays both have the power of regulating the mineral metabolism of rachitis. These wave lengths should be between 3500 and 2000 Angström units, although exposure to sunlight has a similar effect if the exposure is prolonged (hours against minutes with the actinic rays). The shortest of the sun's wave lengths is 2900 Angström units and in cities they are seldom shorter than 3200, which explains why a longer exposure is needed. Negroes are affected as readily as white people. Holt makes the statement: "The healing effect of cod-liver oil and ultra-violet light appear to be due to their ability to promote absorption from the intestines." Only exceptionally are these cases benefited by the use of the water-cooled lamp over the most pronounced areas of the disease, and this should be as an adjuvant to the general treatments. Improvement will often be noted after two or three daily general treatments, which should be given with more caution than is necessary in treating adults.

The child should be stripped and placed under the visible light for ten to twenty minutes with the light at a distance of thirty to forty inches. Follow this with the actinic rays from the air-cooled lamp for one-half to one minute with the lamp about twenty-four inches away, carefully protecting the eyes. Increase the actinic rays about one-half minute daily until a period of eight minutes is reached, seldom more. Treatments should be given daily for a month at least, then less frequently. If at all possible, outdoor life and sea-water bathing should be insisted upon.

Lesne' and de Gennes in Paris Medical (December 20, 1924) theorizes that the ultra-violet rays affect the sympathetic system and through it acts upon the endocrine glands, in this way modifying favorably the calcium and phosphorus metabolism and aiding the assimilation of inorganic phosphorus.

The wave lengths most valuable in cases of rachitis are between 3200 and 2950 Angström units or principally in the near ultra-violet region of Luckiesh.

Complications of rickets are usually the deformity, which may be prevented if the disease is treated early; otherwise, these deformities will be permanent and may require surgery for their partial correction.

The length of time these cases will require treatment will depend upon the stage at which they are first seen and upon one's ability to quickly correct the digestive disturbance which has taken place. However the thing that will tax the ability of the practitioner to the utmost in these cases is usually to get proper feeding and sufficient exposure to sunlight, for many times the parents are unable to furnish either.

The average case should be in good condition in from three to six months.

The prognosis is good as to life, but bad as to deformities.

Case No. 86. Female, age 9 months. She was brought to me August 21, 1922, with a history of diarrhea for the three weeks previous to coming. For several days the stools had been bloody and she was emaciating rapidly, having lost nearly one-half her weight, and had refused both food and water. She was given a prolonged visible-light treatment followed by a one-minute treatment with the air-cooled lamp. Cuprum arsenite in doses of 1/1000 of a grain was given three times daily. There was definite improvement from the first treatment. After six daily treatments, regular feedings were resumed and tomato juice given several times a day. Twelve treatments were sufficient to restore her to a normal diet and at this time she was rapidly regaining her weight.

DIAGNOSIS: Rachitis, incipient.

Raynaud's Disease.

Raynaud's disease, or local gangrene of the extremities, such as toes, fingers, ears, etc., presents a very different picture from the senile gangrene of arteriosclerosis. Raynaud's disease occurs mostly in children or young adults, the other extreme of life, although no age is exempt.

The etiology is a local vascular spasm of the small arteries, which, if continued for a sufficient length of time, will cause occlusion of the lumen, followed by gangrene of the areas supplied

by that particular vessel. Its etiology is a trophic disturbance of central origin, usually superimposed on a neurotic temperament.

The early symptoms are lowered temperature of the involved area, followed by congestion and cyanosis, burning pain, which is not severe, but which is followed by numbness. The condition comes on slowly and extends over months or years.

Treatment. In these cases the general visible-light and actinic-ray treatments, used with *extreme caution*, are among the best methods with which to treat this disease. If possible, double the usual distance of the lamps or have them at a distance of fifty to sixty inches from the patient. This, together with a general management of the case such as to produce the best possible general health, will do the most that can be done for these cases, but one must look for the recurrent attacks and further destruction must be expected. Parathyroid should be remembered and used in selected cases. Some form of calcium should be given orally, of which lime water is the simplest form.

Rheumatism.

Rheumatism is an acute or chronic infection. Practically all of the attacks of rheumatic fever may be classified as acute, although there may be repeated exacerbations over long periods of time; each attack in itself is acute.

The etiology is invariably bacteriology. It usually occurs in the early periods of life, although many of the so-called chronic cases appear late in life as the result of decaying teeth or other focal infections. Exposures to extremes of temperature, particularly of wet and cold combined without adequate protection, is undoubtedly an exciting cause, although if one will look behind this there will be found an infection.

The bacteriology, in the vast majority of cases, is streptococci, but it may be staphylococci and occasionally tubercle bacilli. While the bacteria causing rheumatism may enter at any portion of the body, the majority of these cases can be traced directly to the teeth, the tonsils, sinusitis, appendix or gall bladder, or the gastro-intestinal tract. The accessory sinuses are ports of entry. Remember that the infecting organisms usually enter the body through the orifices, therefore examine these first. In many cases the original foci of infection cannot be found, for the reason that the bacteria at this point may all be destroyed, although not until after other portions of the body have become infected. On the other hand, one may find and remove the original foci, but before its removal the infection may have spread to other parts of the body. The condition then would be the same as if the original foci was automatically eradicated. The infection will remain then in or about the joints and may be active or inactive. It may re-

main inactive for long periods of time only to become active again through some exciting cause, as exposure to inclement weather, a debilitated condition of the system, etc.

Smears or cultures, particularly from the teeth and tonsils, will aid materially in clearing up the diagnosis.

The blood picture is seldom more than that of a secondary anemia, which is usually not of a severe character, although leucocytosis is very pronounced in cases of acute infection.

The cardinal symptom of all rheumatic cases is pain and it may be in one joint, or in nearly every joint of the body. If the infection spreads to other portions of the body, particularly those lined with endothelium or the serous membranes, as those of the heart, this symptom of pain will be a constant accompaniment, and as the case improves will be one of the first to diminish. The usual symptoms are those of infection in any area of the body, which in rheumatic cases is most pronounced around the joints which become enlarged, edematous, swollen, red, and exceedingly painful to contact or motion.

The differential diagnosis will necessitate finding the etiological bacteria and the complicating features of the case. Gonococci produce an inflammation usually in one joint only, which goes under the popular name of gonorrheal rheumatism. Other diseases from which rheumatic fever must be differentiated are gout, scurvy, periostitis, osteomyelitis, and septic, traumatic, tubercular and syphilitic arthritis.

The general management of these cases will require a hygiene which will aid in the destruction of the infection. Exercise and rest are usually controlled by the seriousness of the case and the amount of pain produced by motion.

Colchicin in doses of 1/100 of a grain several times daily, or until the physiological or cathartic action takes place, is one of the best remedies internally. Other internal remedies are rhus tox. in doses of 1/100 of a grain. Aconitum nap. in drop doses of the tincture every half hour until profuse sweating occurs, will aid materially in the acute stages. Bryonia in doses of 1/10 to 1/100 of a grain is one of the best remedies for serous membrane involvement. Intravenously the salicylates, sodium iodide and colchicin are of value, while locally magnesium sulphate, in a solution of one ounce to a pint of water, used as a wet dressing either hot or cold at the discretion of the patient, will afford very much relief.

Physiotherapy offers much for the relief of these cases, administered in the form of prolonged visible-light treatments, using a 1000-watt bulb, two or more of which may be suspended above the patient, or better yet, if possible, use an electric-light bath cabinet. These treatments are to be followed by the use of actinic

rays and frequent bathing with soap and water, followed by a sponge bath of magnesium sulphate, one ounce to a pint of water, which is allowed to dry on. Where the inflammation is limited to a single joint, or not more than two or three, diathermy given through and through the joint is of value. This is particularly true of the gonorrheal infection, from which usually but one joint is involved. Here the temperature of the joint can be raised to a sufficient degree to destroy the gonococci, which is about 106° F. This heat should be maintained from thirty to forty-five minutes, after which most of the pain will have disappeared and there will be a therapeutic response which will diagnose the case, for the ordinary streptococcic and staphylococcic rheumatic joint will not yield in this length of time, as they require a much higher temperature for their destruction.

Tubercular joint cases are benefited more by the use of the actinic rays and visible light, both for local and general treatments, than by diathermy.

The complications which may arise in the course of a case of rheumatic fever are manifold, as every tissue in the body may become infected. Principal among the complications, however, are the cardiac involvement of the endocardium and pericardium, both local and general. Pleuritic involvement, as well as gastro-intestinal, is common. Diathermy may be used for these complications, but must be used cautiously. The milliamperage used should not be for more than $\frac{1}{3}$ or $\frac{1}{2}$ of skin tolerance, and this for a period of ten or twenty minutes at the beginning of the course of treatment. At all times the milliamperage passed through the heart must be small, although the time may be lengthened if there is no reaction.

Periostitis and synovitis are a part of nearly every case and permanent deformities are frequent complications. Cerebral complications are usually those of delirium and due to the high fever from the infection, although at times a cerebritis or meningitis may develop. As the disease is one of the most common the practitioner has to treat and as the complications are so varied and serious, thorough constructive treatment should be started at the earliest moment possible and persisted in until complete relief is attained. The majority of these cases can be restored to a fair degree of health and usefulness, but if the focal point cannot be removed one must not expect more than temporary results. Recurrence is not only possible, but probable, and with each recurrence the severity of the symptoms increases and the deformities become more pronounced and the invalidism more permanent.

The average length of time an acute case will require treatment will be from a few days to a few weeks. In these cases, which have had recurrences over a number of years with a great deal of

deformity, the prognosis for relief may be good, but to expect complete recovery is to expect miracles.

Rhinitis, Acute and Chronic.

Rhinitis per se is comparatively a rare disease. It initiates or ushers in an infection of the turbinal, septal, and other mucous membranes of the nose and accessory sinuses.

In type, it is usually acute, although at times it becomes chronic, and in the latter case is usually associated with a hypertrophy of the turbinates, polypi, adenoids, exostoses, or infection of the accessory sinuses.

The direct etiology of the disease is either a microörganism or a diminished resistance associated with microörganisms. There is little difference in the treatment of the case. The microörganisms most frequently found in the acute cases of rhinitis are the micrococcus catarrhalis, bacillus of Friedlander, and pneumococcus. However, streptococci and staphylococci almost always accompany, and this is particularly true if the acute coryza or rhinitis ushers in an acute infective disease, such as influenza, whooping cough, scarlet fever, diphtheria, etc.

The underlying cause of most of these cases is lowered resistance or immunity from any cause. Overheated or poorly ventilated rooms are primal etiological factors in many cases, particularly when there is pathology in the nose or accessory sinuses.

The pathology of an acute rhinitis is at first a congestion, followed by a local inflammation of the mucous membrane over the septum and turbinates, with a change in secretions from the watery discharge to the one of thick mucus, or mucus and pus. At this stage, the infection usually spreads to the accessory sinuses and here it is most likely to become chronic. If the disease can be controlled in the acute stage, the inflammation subsides and these conditions decrease in the reverse order to a normal status, providing, however, that there is not definite pathology within the nose or upper respiratory tract sufficient to keep up the irritation. The most common of these are polypi, hypertrophic turbinates, adhesions and exostoses.

Certain drugs will produce symptoms similar to an acute rhinitis, with this exception, that they seldom go on to pus formation. Among the most prominent of these are chlorin, bromine, formaldehyde, potassium or sodium iodide and hydrochloric acid. However, if these irritations are prolonged, the destruction of tissue, or even life itself may result. Their first action is irritation, followed almost immediately by the closure of the nostrils, nature's method of limiting the amount of damage done. This is closely followed by a free watery discharge to wash away the irritant.

Symptoms. Usually the first symptom of an acute rhinitis is a slight chill or creepy feeling, immediately followed by a tur-

gescence of the nasal mucus membranes and slight aching throughout the body, with a feeling of lassitude.

Etiology. It is seldom that this condition is produced if a person is in the open air, although sudden chilling in extremely cold weather, especially if one has been perspiring freely, may produce it. However, in this case one is much more likely to develop inflammatory trouble in the deeper tissues. Rhinitis is superinduced by lowered vitality, heavy clothing, over-heated and over-crowded rooms. Poor ventilation accounts for many more cases. In short it is a mild contagion, easily given to those who come in close contact.

The diagnosis of this condition is easy if seen in the first stages or before the disease has extended to adjacent tissues, which it does after the first forty-eight hours. This extension is usually into the accessory sinuses and down the mucous membrane through the pharynx, larynx, and the trachea to the bronchi and lungs, carrying with it the inflammatory process and infection. However, if these cases are given anything like the proper treatment, the disease should be limited to the upper air passages and the patient restored to a normal condition in a few days. The most of these cases can come to one's office for treatment.

The general management of these cases will require extreme cleanliness and plenty of fresh air. In place of fresh air being an etiological factor in these rhinitis cases, they could be cleared up if the individual could be put outdoors and compelled to live in the open air. The overheated, cold, or ill-ventilated room should be forbidden. Extra clothing, just enough to keep the body warm without perspiring, outdoor life, or wide open windows often is all that is necessary. Exercise in the open for those so afflicted should be advised. Rest in bed in an over-heated room is probably the worst thing that could be done for the case. The diet should be light or even a fast for a day or two would be advantageous. The bowels should be moved immediately to avoid absorbing toxins from this source. Mild saline cathartics, of which magnesium citrate is a type, are best for this purpose.

Treatment is necessary only for the associated pathology rather than for rhinitis. Internal remedies are of extreme value in the treatment of these conditions when proper hygiene and fresh air cannot be maintained. The old household remedy of spirits of camphor is one of the best and should be given in doses of five or ten drops on sugar every fifteen minutes until a profuse perspiration is established. Aconite in doses of one drop of the tincture administered every half hour or hour until the patient is perspiring profusely will probably be better but more dangerous to use. The dose given is for adults. For the excessive secretion, atropine in doses of 1/200 of a grain gives almost immediate relief. It may be used subdermally but this is seldom necessary. Intravenous

use of sodium iodide, 32 grains, and guaiacol, $\frac{3}{4}$ of a grain, is of benefit, but it must be remembered that the iodine will often increase the watery secretion of the nose, which need not prevent its use.

A good nasal hygiene is of value. Usually one of the alkaline solutions should be used. Magnesium sulphate, $\frac{1}{4}$ to $\frac{1}{2}$ of a dram in eight ounces of water, is one of the best to use as a nasal douche, or one can use a powder composed of one part of magnesium sulphate triturated with nine parts of finely powdered sugar and a few crystals of menthol. This tends to shrink the mucous membrane, thus allowing free passage of air; at the same time it reduces the inflammation, lessens the secretion, and adds to the comfort of the patient. Nasal packs of argyrol 10% are of distinct value.

Physiotherapy offers a distinct aid to these cases and the modality to use is actinic rays from the water-cooled lamp, the rays being thrown directly into each nostril through a quartz applicator for one to two minutes daily for the acute, twice weekly for the chronic case.

Complications are infections of any of the upper air passages and their mucous membranes, unless the rhinitis precedes an infective disease.

Other complications are rapid extensions of the infection to other portions of the body. If uncomplicated, these cases should not require treatment longer than a few days.

The prognosis for rhinitis is always good.

Case No. 568B. Female, age 26. Came to me for treatment January 23, 1920, complaining of constant bloody discharge from the nose. The left turbinate had been removed in 1918. Tonsillectomy the same year. In 1919 she had some infected teeth extracted.

Examination at that time revealed a perforated septum, the opening being about 2 cm. in diameter. The edges of the opening were crusted and it was from this area that the blood came which mixed with the nasal discharges. She had been under treatment for the perforation for nearly a year. The blood and spinal Wassermans were negative.

Her treatments consisted of general visible-light and actinic-ray treatments for her general condition and local treatment to the nasal cavity with the rays from the water-cooled lamp for two or three minutes, three times a week, followed by a topical application of a 10% solution of oleum terebinthinae in oleum olivae. After nine treatments the bleeding stopped and after fifteen treatments the erosion about the perforation had healed.

DIAGNOSIS: Ozena or Atrophic Rhinitis. See page 333.

Rhinitis Hypertrophy.

Hypertrophic rhinitis is treated along the same lines as the atrophic, although they are of exactly opposite pathology. The

hypertrophy occurs in the mucous membrane of the nose over both the septum and the turbinates. With the hypertrophic rhinitis there is an increase in the blood supply of the mucous and sub-mucous tissues producing more or less obstruction to the passage of air through the nasal cavities, which is the cardinal symptom of this disorder. With this is associated an increase in the amount of nasal secretion like that found in the acute rhinitis, except that in this instance the nasal secretion is more or less constant and aids in locking up the air passages. The increase may be either unilateral or bilateral; usually it is the latter.

The diagnosis of this condition is usually very easily made upon inspection of the nasal cavity, when it will be found that the mucous membrane is thickened, the air passages blocked, and there is a marked engorgement of the vessels producing dark red or purple color of the mucous membrane. The disease is more likely to be found in those having constitutional disorders and congestions in other portions of the body.

The general management of these cases will consist of a good hygiene and cleanliness of the nasal cavities. Alkaline solutions are of decided value in maintaining this cleanliness. Here again oleum terebinthinae in a ten per cent solution in oleum olivae will be found of value both for cleanliness and its stimulative antiseptic action on the capillaries.

Exercise and outdoor life aid in the correction of the condition, particularly if there are underlying constitutional disorders.

Surgery is at times required where there is a deviated septum, an exostosis, or where the turbinates are very large and limit the passage of air. Drugs internally have but little effect on this condition. Most of the drugs used locally, as adrenalin, cocaine, etc., have but temporary action and their reactive dilatation leaves the condition really worse than it was in the beginning.

Differential diagnosis. It should be distinguished from any infective fever, from hay fever, and asthma.

Physiotherapy offers the same aid it does for the atrophic cases. Actinic rays from the water-cooled lamp thrown into the nasal cavity are used to revitalize the cells. Actinic rays are also used to contract the capillaries, thus reducing the hypertrophied membrane. This is done by slightly blistering the mucous membrane of the nostrils, more particularly that of the turbinates. The treatment should be from one to three minutes with the applicator in the nostril. This will cause immediate reduction without reactive dilatation. Before the actinic-ray treatment is given, it must be definitely known whether exostoses, adhesions, polypi, or other gross pathology are present. If present, this pathology should be removed surgically.

In cases in which the actinic rays are not sufficient, the d'Arsonval current, using a needle electrode in the nose, the indifferent pole on some other portion of the body, can be used to destroy

the mucous membrane and if necessary a portion of the turbinate. It should not be used for exostoses because of the danger of septal perforation. It can, however, be used for destroying adenomas, fibromas, papillomas, or polypi within the nasal cavity. As a local anesthetic, Butyn (two per cent) upon cotton is usually sufficient. This operation has the advantage over the cutting because it is bloodless. The case does not need to be hospitalized, as these treatments can be given in the office. If bone is destroyed by coagulation, it will take from six weeks to three months for the bone slough to loosen so that it can be removed.

The d'Arsonval current should be used with extreme caution upon the turbinates, for the action is very rapid and there is likelihood of having a perforation of the septum. In severe cases, it is best to destroy the turbinates and overlying mucous membrane with the d'Arsonval current, leaving the mucous membrane on on the septum to be taken care of by the actinic rays.

Radium can be used in these conditions by placing the capsule against the turbinates for destruction of the arterioles. This produces an endarteritis and when so used must be with extreme caution, using from ten to twenty-five milligrams for one to three hours at a sitting and these treatments should not be given more than once in four weeks. The screening should be $\frac{1}{2}$ millimeter of silver and 1 millimeter of rubber.

Trichloroacetic acid in a fifty per cent solution can be used in these cases when other methods are not available. However, drugs are not equal to physiotherapeutic measures. Polypi are frequently an accompaniment of hypertrophic rhinitis. A chronic inflammatory process may produce a multitude of small polypi rather than a large one. These are best destroyed by the use of the d'Arsonval current after removal of any large mass by cold snare.

These cases will require treatment from a few weeks to months.

The prognosis is good as to life, but if allowed to go untreated may lay the foundation for some grave constitutional disorder.

Rhinoscleroma.

Rhinoscleroma is a rare disease of the nasal mucous membrane and is found principally among the foreign born.

The etiology is supposed to be the Frisch bacilli or the rhinoscleroma bacilli.

Pathology. It starts in the mucous membrane in any portion of either or both nostrils. It progresses slowly and produces no symptoms beyond the nasal sclerosis and eventual stenosis.

In the treatment of this condition, surgery offers but little hope of anything but temporary results. X-ray and radium are the best treatment. Bare needles containing five to ten milligrams

of radium sulphate should be inserted into the sclerosed tissue about two centimeters apart, and left for two to four hours and should not be repeated as long as improvement continues. In many cases one treatment will be sufficient. The radium treatment should be followed by actinic-ray treatments with the water-cooled lamp three times a week for about one minute each treatment. This is given in the hopes that it will destroy all the bacilli and thus aid the radium in the recovery of the case and in the prevention of a recurrence.

Scurvy.

Scorbutus is a vitamin C deficiency occurring in infants, children and adults.

Its etiology is improper foods and improper feeding.

Its characteristic symptoms are malaise, emaciation, dyspnea, anemia, and sore and bleeding gums. In far advanced cases, there is necrosis of the alveoli. Subcutaneous and subperiosteal hemorrhages are common during the late stage. The accompanying symptoms in children are restlessness and pain and swelling over the long bones, particularly over the tibia, which is due to subperiosteal hemorrhages. These children fear the slightest amount of handling, as it increases the pain.

It must be differentiated from ulcerative stomatitis, infantile paralysis, acute articular rheumatism, and secondary anemia due to other diseases.

The general management of the case requires special hygienic care, outdoor life with moderate exercise when possible, and principally a diet rich in vitamin C. For this use such foods as all citrus fruits, of which the orange is the most potent, limes the least, tomatoes, using the juice only for infants, cabbage, lettuce, spinach, green beans, and peas.

Surgery is needed at times for complications. Drugs are of little use. In physical therapy the general visible-light and actinic-ray treatments are of extreme value. These cases will require treatment for a few weeks or months.

The prognosis is good.

Sciatica

Pressure, infection, injury, bone necrosis, or neoplasms give the etiology of this disease.

Sciatica may have for its etiology anything from a simple constipation to fibroid tumors, growths within the pelvis, back, or spine, metastatic carcinoma, particularly from the breast, fracture or dislocation of the coccyx. Relaxation of the sacro-iliac synchondrosis is a frequent etiological factor and it must be ruled out before treatment is started, likewise pelvic malignancies.

For the inflammation and pain accompanying neuritis, neuralgia, sciaticas, etc., surgery offers but little except as it relates to the underlying etiology. The same may be said of drugs.

The etiology removed, physiotherapy offers much for this class of cases and it would be hard to decide which is the most valuable, visible light and actinic rays or high-frequency currents. Sometimes one and sometimes another seems to work best. When diathermy is used, the applicators of composition metal (No. 22 B&S gauge) will have to be variously placed for the different cases. Where the pain is principally about the hip, one applicator should be placed anteriorly, the other posteriorly of this region. If the pain is the entire length of the leg, use one applicator over the lateral lumbar and sacral region and the other about the foot or the foot may be immersed in a dish of water into which the terminal is placed. In this way, the entire limb is brought under the influence of the heat. The milliamperage used will be that which is comfortable to the patient. Occasionally it is best to combine the high-frequency currents and actinic-ray treatments, either on alternate days or at times using both mildly on the same day. Galvanism offers decided relief in some cases when the other measures have failed. Faradism and massage are of value after the inflammatory period has passed but not before. Simple heat offers relief and can be used in any form when other treatment is not available. However, it should be used as near continuously as possible. The best form of continuous heat is the infra-red rays. Where hot packs are used, magnesium sulphate in a solution of one ounce to a pint of water is the best with which to medicate them.

After the inflammation has subsided, slow sinusoidal current or slow sinusoidal with the rapid sinusoidal superimposed does much to correct muscular atrophy and paralysis. This should be used with extreme caution for the reason that it is easy to over fatigue a muscle. A mild current should be used for not more than ten minutes for any one set of muscles. These treatments should be given daily until there is definite progress, then three times or twice a week.

Septicemia.

Septic infections are commonly known as toxemias, septicemias and pyemias. These may occur separately or all in one case.

They have for their etiology an infected area which may be in any portion of the body. These infected areas may be large as when a portion of the placenta is retained, or small as from a needle the point of which had previously been infected. Persons with a lowered vitality are particularly prone to develop these infections.

Laboratory findings usually give the streptococcic bacteria as the one producing the most violent infections, next in order the pneumococcus, colon bacillus, with staphylococcus usually least of all.

In pathology the toxemia or septicemia is typically a blood poisoning in which the toxins or bacteria themselves penetrate into the blood stream and are carried to various portions of the body. When the septic matter is carried with them and finds lodgment in any portion of the body, we have a typical case of pyemia and this may occur in any tissue.

The diagnosis is usually easily made upon finding the infected area and by the cardinal symptoms. First there is a chill followed almost immediately by a rise in temperature. The skin at first is hot and dry, but in a short time becomes cool and edematous, and later on cold and clammy as the disease progresses. The blood deterioration and the destruction of its immunity occur rapidly. There is a definite intoxication which assumes various types from mere dizziness to coma, if the area of infection is large and the absorption rapid, death may occur within twenty-four hours; if, however, the system develops enough immunity to stop the general infection, pyemia may develop and continue for many months. The disease is definitely infectious and extreme care should be used that others do not become infected by contact of abrasions.

The general management of these cases will require the best hygiene possible, absolute rest in bed until the acute symptoms disappear, a diet that is light or, better still, fasting during the acute stage. The less food put into the stomach while the body is running a high temperature the better, for food cannot be properly digested under these conditions and thus adds to the toxemia already existing. The bowels should be kept free. As many of these cases suffer from diarrhea, it will be necessary after the first few days to control this by the use of castor oil in doses of one teaspoonful daily and copious enemas containing an ounce or two of magnesium sulphate to each quart of water. Later, should a colitis supervene, use a retention enema of fluid extract of krameria, ten to twenty per cent in warm water, using two to four ounces of the dilution daily.

Treatment. Surgically these cases must be well drained as the first step in their treatment. Infected wounds must be laid open at the source and subsequent cavities opened for adequate drainage. Limbs need not be slashed; if there is a definite abscess formation these should be simply lanced. The treatment of the accompanying lymphangitis has already been given under that heading and should be followed closely. Drugs are definitely beneficial, but give the best results when given intravenously or subdermally. Strychnin nitrate in doses of 1/100 to 1/20 of a grain may be given subdermally, at times being replaced by iron cacodylate and nuclein. Intravenously sodium iodide 32 grains and guaiacol $\frac{3}{4}$ of a grain is one of the best remedies we have. Locally antiseptic dressings must be used, which may be saturated with dilute antiseptics, using olive oil or water as a vehicle.

If the foci of infection is near the surface, the use of physiotherapy in the form of actinic rays is usually all that is necessary. If the infection is near one of the orifices of the body or is in a small surface lesion, the water-cooled lamp should be used at a distance of one-half inch for one to three minutes. These treatments should be given daily or even twice daily for the first few days and less frequently according to indications.

Drugs for local treatment of this condition, where actinic rays are not available, are mercurochrome in a one to two per cent solution, oleum terbinthinae in a ten to twenty per cent solution in oleum olivae, or wet dressings or packs of aluminum acetate, saturated solution, or magnesium sulphate one ounce to a pint of water, will aid materially in destroying the infection. For a day or two a saturated solution of magnesium sulphate may be used. It should not, however, be used for any great length of time, as it is likely to produce an eruption which heals slowly. This eruption is very similar to that produced by iodine. Aluminum acetate in a saturated solution is non-irritating and very active.

In addition to the above, general visible-light and actinic-ray treatments should be used and if the area of primary involvement is superficial, visible light should be used continuously over the area until there is definite improvement, then decrease the time and frequency of application according to the needs of the case.

The average length of time these cases will require treatment will be from a few days in the simple cases to months in the pyemic case.

Complications are all infective processes and may affect any organ or any tissue in the body, thus any concurrent disease may be assumed to be due to the original infection until proved otherwise. The heart, kidneys, liver, and lungs should be watched carefully for foci of infection.

The prognosis in the streptococcic type is bad, particularly if the invasion is rapid. In the staphylococcic type it is usually favorable provided sufficient drainage is maintained and proper treatments given. Pyemic cases usually recover in the course of months, provided erysipelas with its streptococcic etiology or a mixed infection does not take place in some of the abscesses or their sinuses, thus rendering an unfavorable prognosis. Gonococci may be classed as an etiological factor in cases of septic infection, but its action is usually limited, involving tissues by continuity, or at most one or two joints, unless other bacteria are introduced. Only occasionally do gonococci produce an endocarditis.

Sinuitis.

Sinuses accessory to the nose are lined with mucous membrane and are thus liable to acute and chronic disorders starting in the nares. Many of the inflammatory conditions start in childhood and are associated with childhood diseases, mostly the infectious erup-

tive disorders. Adenoids, polypi, and hypertrophies are common etiological factors and if not corrected in childhood are etiological factors of chronic inflammation in the adult which spread through the various sinuses.

Etiological factors which occur late in life are syphilis, tuberculosis, carcinoma, sarcoma, adenoma, etc., and may spread from the nares to the sinuses or in the reverse order. Tubercular bacilli are a frequent etiological factor. Empyema may occur in any of these cavities, and when it does occur it constitutes a very chronic disorder, yielding many times only to the most vigorous surgical measures.

The pathology found will depend upon the etiological factors in the case and the location of the diseased process. In simple acute inflammatory conditions of the nares and accessory sinuses, there is the usual edema of the mucous membrane in the early stages, accompanied by congestion, inflammation, and abnormal secretions. If the disease becomes chronic from any cause, there will be either a hypertrophy, with thickening of the connective tissue or atrophy. In either case there will be abnormal secretions and these continue to become more thickened, and as mixed infections develop, these secretions will become purulent, and if erosion of the mucous membrane occurs, they will be mixed with blood.

Papillomas, adenomas, fibromas, occurring in the nose or sinuses, or extending from one to the other, contain the characteristic tissues of the disease. Malignancy may occur in any of the accessory sinuses, spreading into the orbit or nares, and afterwards to the surface.

Both benign and malignant growths produce very few symptoms until the disease increases to a size where pressure and atrophy of the tissues have taken place.

There are first pressure symptoms and later pain. In all malignant lesions, pain is a late symptom and usually occurs after the prognosis has become hopeless.

The cardinal symptoms of both the acute and chronic types of infections within the nose are the increased quantity of the discharge and the characteristic change from the simple water-white mucus to that of a mucopurulent or blood stained tenacious secretion. If the normal opening into the sinuses becomes occluded, pain becomes one of the cardinal symptoms.

The diagnosis is made on the character of the discharges, cultures from the infected areas of the nasal cavity, and trans-illumination. In no part of the body is trans-illumination as valuable as in the diagnosis of these conditions.

The differential diagnosis must be from benign and malignant tumors, also atrophic rhinitis which is a late stage of these infections.

The general management of these cases requires a good hygiene, plenty of outdoor life and exercise, and fresh air at night.

Rest is not essential, except in the acute stages, when it may be imperative. Diet should be such as to build up the best resistance to the body, and the bowels kept free but not watery.

In the treatment of these conditions surgery is indicated for drainage and for removal of the benign and if possible of the malignant tumors. The treatment of the acute infection may be internal, with aconite, belladonna, bryonia, rhus tox., or calcium iodide. Drugs subdermally as iron cacodylate and nuclein and intravenously sodium iodide and guaiacol are valuable. Locally the silver salts in solution of from five to ten per cent or mercurochrome in a solution of from one to five per cent may be used as packs. Magnesium sulphate in a solution of one-fourth dram in eight ounces of water may be used as nasal douches for cleansing the cavities.

Physiotherapy offers much in these cases. In the acute cases the visible light should be given for an hour or more directly over the face at a distance comfortable to the patient. This is followed by a general actinic-ray treatment for one minute, increasing it to ten minutes. Actinic rays should then be used from the water-cooled lamp through the quartz applicator into the nasal cavity, covering all surfaces for one to three minutes in order to shrink the mucous membrane and improve the drainage, and many times this alone would avoid the necessity of surgical drainage. This usually relieves pain within a short time, and if persisted in will relieve many of these cases without resorting to surgery. On the other hand, the old chronic cases of empyema, where adequate drainage cannot otherwise be established, surgery must be resorted to, but following surgical drainage actinic rays and visible light should be persisted in as the best measure for restoring the infected mucous membrane to normal.

Complications are comparatively rare in sinus infections, yet they do occur as pyemia, empyema, destruction of the bone, middle ear infection, meningitis or cerebral abscess.

The average length of time that it will be required to treat an acute sinus infection is from a few days to a few weeks, while the chronic cases will require from a few weeks to months.

The prognosis is usually good in these cases unless there is a mixed infection with the complications given above.

Case No. 264. Male, age 30. Gave the following history when he came to us on July 6, 1917: Four years ago he began to have a dull pain in supraorbital region, which came on periodically, lasting from a half-hour to a week; but for the past year it had been almost constant, with, at times, a greenish-yellow discharge from the nose. He had taken treatment from a number of doctors, but with very little relief.

On July 6th we gave him a forty-minute treatment with the visible light and five minutes of actinic rays, with the air-cooled

lamp, at a distance of twenty-four inches, with some relief of pain before he left the office. The following day there was very little soreness and no pain. The treatment was duplicated, with complete relief of all symptoms. Other treatments were on July 9th, 11th, and 12th, of the same duration and distance. August 27, 1917, he reported that he had had no return of the trouble.

DIAGNOSIS: Sinusitis.

Case No. 301. Male, age 59. Has had trouble with his nose and sinuses for the past three years. One month ago he had the right inferior turbinate removed. Two weeks later he had a second operation at the same hospital, neither operation giving relief. Because of the pain, he had been unable to sleep on the right side of his face for the past month.

Actinic-ray treatments were given as follows, using a solid-quartz applicator:

DATE	VISIBLE LIGHT	ACTINIC RAYS		CLINICAL FINDINGS
1917	Duration of Treatment	Water-cooled Lamp		
		Duration of Treatment	Location of Applicator	
Sept. 14	30 min.	3 min.	In nose	Immediate relief. Slept on right side of face.
Sept. 15	30 min.	2 min.	In nose	
Sept. 17	30 min.	2 min.	In nose	Discharge freer. Very much improved.
Sept. 19	30 min.	3 min.	In nose	
Sept. 21	30 min.	3 min.	In nose	
Sept. 25	30 min.	3 min.	In nose	No pain.
Sept. 28	30 min.	3 min.	In nose	
Oct. 1	30 min.	3 min.	In nose	
Oct. 8	20 min.	3 min.	In nose	
Oct. 18	20 min.	3 min.	In nose	

DIAGNOSIS: Sinusitis.

Case No. 440. Female, age 20. Was referred for treatment November 26, 1924. Her history showed that for three years she suffered with pain in and about the accessory sinuses. During most of this time she had a thickened nasal discharge, frequent colds, and a cough.

Had a tonsillectomy and adenoidectomy eight years previous to this date.

Her treatments were general visible-light which was prolonged to 30 minutes over the face, 10 minutes over the back and followed by actinic rays from the air-cooled lamp for 1 minute, increasing to 8 minutes after as many treatments. This was followed by actinic rays from the water-cooled lamp thrown into each nostril for 2 minutes through a solid quartz applicator. Sodium iodide and guaiacol were given intravenously at weekly intervals.

There was steady improvement and relief of all symptoms after fourteen treatments.

DIAGNOSIS: Sinusitis.

Strictures, Esophageal, Urethral, or Rectal.

Ninety-five per cent of the strictures of the male or female urethra is the result of venereal infection and five per cent the result of trauma either instrumental or from external violence. These may be treated with bulbous bougies attached to the negative pole of the galvanic current using a bulb just large enough to pass the stricture for the first treatment and a size larger each subsequent treatment until the full size of the urethra is attained. When the galvanic current is used, the indifferent or positive pole should be placed over the lower abdomen. The milliamperage should be from three to twenty for a period of five to fifteen minutes once or twice a week.

We now have a better method and that is the flexible heat bougie. Their use is much less painful than metal instruments, the effects much quicker, much more positive as well as more lasting, and there is less trauma. If a small bougie can be introduced, the immediate relaxation produced by the heat will permit the immediate passage of a size larger. If it is impossible to introduce a small heat bougie, it will be necessary to use a flexible guide, or filiform bougie to aid in the introduction of the guide which is then attached to a dilating catheter and the urethra dilated to a sufficient size to allow the introduction of a small flexible bougie.

The bougie should first be heated to a comfortable temperature, about 104° F., well lubricated with a tragacanth lubricant (because it is water soluble) and then carefully introduced until the tip enters the bladder where it is allowed to remain for a minimum time of thirty minutes. The temperature is raised after introduction to the tolerance of the patient, which is about 110° F. It may be beneficially used for one hour. The bougies should be sterilized with a 40% formaldehyde solution.

Even in very bad cases, five to ten treatments given at intervals of once or twice weekly are all that are necessary to relieve the patient for many months and in some cases for many years.

Multiple strictures are as easily controlled as single ones. As soon as there is any diminution in the size of the stream, these treatments should be repeated, but only a few (three to five) treatments will be needed for redilatation. Their use is called for first because they are more humane, second because they are more effective, and last, but not least, they are less destructive of the urethral tissue. Bougies giving infra-red rays are of value and can be used in the majority of these cases for thirty to sixty minutes. These methods will be found far superior to the use of the steel sounds or dilators.

The same may be said of benign esophageal or rectal strictures and the same line of treatment may be followed. The urethral cases are seldom malignant.

In the esophageal and rectal cases the etiological factor is usually a malignancy, possibly a chronic infection with ulceration, a traumatism or a post-operative contraction; therefore, the cases will require much care and skill in the introduction of the bougie as further trauma must be avoided. All bougies should be well lubricated.

Complete benign rectal strictures require a colostomy, while complete benign strictures of the esophagus require a gastrotomy. All physical-therapy treatments must be considered as palliative or arrestive. The treatment should be of at least thirty minutes' duration and longer ones will be beneficial. They should be twice a week for two or three weeks, then less frequently.

Case No. 306. Male, age 25. Was referred to me February 14, 1925, for treatment of urethral strictures. The doctor who referred the case was unable to pass even a filiform bougie. The patient had a Neisserian infection in October, 1924, and had been treated with silver nitrate.

My treatment was entirely with heat bougies, one of which I was able to pass the first time he came for treatment. Larger sizes were used each subsequent treatment. In the course of two months, six treatments were given and were sufficient to relieve him of all obstruction.

DIAGNOSIS: Strictures, urethral.

Synovitis.

Synovitis is theoretically an inflammation of the synovial membrane alone. However, this seldom occurs, for in the majority of cases it is associated with inflammation of the joints, thereby constituting a definite arthritis.

The types may be either acute and chronic.

In etiology, the majority of the cases are traumatic. The vast majority of the septic cases are not true synovitic cases, but rather that of arthritis and are typed according to the etiological organism as staphylococcic, streptococcic, tubercular, gonorrheal or syphilitic. Loose bodies in the joints associated with synovitis are occasionally the result of injury, although almost invariably it is a tubercular process which produces the well known cartilaginous beans.

In a clear case of synovitis due to traumatism the pathology is that of a simple inflammation, which should subside without further involvement or impairment of function. If, however, one of the pus-producing organisms invades the area, the case then becomes one of arthritis and must be treated as such.

The cardinal symptom of synovitis is that of infection or inflammation in any other part of the body. Pain is the first symp-

tom due to the injury. It is also due to the outpouring of synovial fluid within the joints causing pressure. If with the traumatism there is infection, the condition then carries the usual symptoms of infection, including redness and swelling not only of the synovial membranes, but of the structures surrounding the joints.

In diagnosis it must be differentiated from the arthritic or rheumatic cases, injuries, dislocations, fractures and bursitis.

The general management of these cases will require rest to prevent further injury. Rest only of the joint by cast or splint, or complete bodily rest in bed must be taken according to the severity of the case. With rest in bed a light diet should be prescribed to aid in the reduction of the congestion.

In treatment, surgery offers but little for the straight case of synovitis either acute or chronic. Surgery is usually limited to immobilization, aspiration or drainage, which may be used if necessary, but neither should be done until other methods have been thoroughly tried out and proved ineffective, which will be seldom. If the infection produces a pus formation, it must necessarily be drained. The drainage need not be large, but should be adequate to take care of the debris. The question of injecting antiseptics into the joint must be left to the individual practitioner, but usually it will not be necessary.

Drugs internally have but little effect upon the synovitis, but may be used to control certain symptoms or coexisting conditions. If there is an infection in the joint, the intravenous use of sodium iodide 32 grains and guaiacol $\frac{3}{4}$ of a grain will be of benefit. Wet dressings of boric acid, aluminum acetate or magnesium sulphate may be used, provided other measures are not at hand. Of these the magnesium sulphate is most important and should be used in a solution of one ounce to a pint of water, which may be used hot, cold, or at room temperature—preferably the latter. One thing, however, must be insisted upon and that is that the joint be kept extremely wet and the application persisted in. It should be kept on night and day until there is definite absorption of the exudate, which will usually begin to take place within twenty-four hours. Many times this is the only treatment needed.

Physiotherapy offers much for these cases and the visible light is probably the best modality to use unless there is an infection, when actinic rays from either the air-cooled or water-cooled lamp should be used following the visible-light treatment, which should be of sufficient time to produce a good hyperemia. To get the best results, visible light should be used for long periods of time, one hour treatments being a minimum. The distance of the lamp from the joint should be comfortable to the patient.

Splints and plaster casts need not be used unless the individual is supposed to be about and most of these are used to control

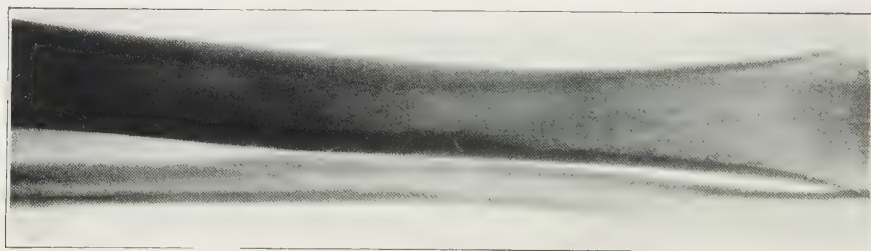


Aneurysm of the aorta. Tertiary luetic lesion.

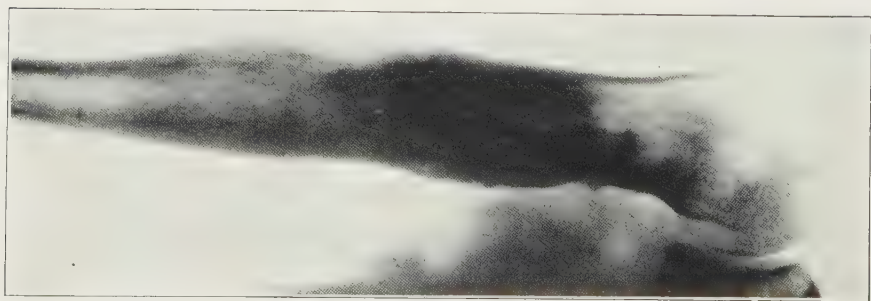
Plate LV



Tertiary syphilis of stomach.



Tertiary syphilis of fibula.



Osteomyelitis of humerus in contrast appearance to syphilis of bone.

motion. However, it is better for these cases to sit or lie down with the joint elevated.

While visible light is usually all that is necessary to prevent or remove lymph or blood stasis, at times massage without joint motion will be of value. Fibrous ankylosis, either partial or complete, may take place following synovial inflammation.

Diathermy is particularly valuable before pus formation and after the inflammation has subsided and fibrous bands limit the joint motion.

Synovitis with adhesions is treated most advantageously by the use of the d'Arsonval current through the knee joint from various angles, but it must be remembered that to get results from diathermy, it is necessary that the composition-metal applicators be directly opposite each other so there is no short circuiting along the skin for in this way only can the heat be driven through the joint itself and this is necessary if absorption of fibrous tissue is to be obtained.

Complications have already been given which are arthritis with or without pus formation, osteitis, and in severe cases osteomyelitis.

The average length of time these cases will require treatment will depend upon the etiological factors. Those resulting from injury will require treatment the length of time that injury requires treatment, whether it is fracture, dislocation, or simple inflammation. If complications arise, it may take weeks or months and various treatments to restore the case to normal. The simple synovitic case, if given proper physiotherapeutic treatment, should be well in from a few days to a few weeks at most.

The prognosis is usually good excepting complications.

Syphilis.

Syphilis is not considered in this treatise for the reason that it is not considered a disease which can be treated by physiotherapeutic methods. Visible light and actinic rays for general treatments will probably benefit these cases to a slight extent but they should not be used as the treatment for syphilis itself but for some of its manifestations, such as gastric crises.

Tabes Mesenterica.

There are acute and chronic types of tabes mesenterica.

These cases are characterized by enlargement of the lymph nodes particularly in the mesentery although other glands may be enlarged in any portion of the body, especially in the cervical region.

The etiology is the tubercule bacilli usually of the bovine type. The disease usually occurs in very young children, most of them are bottle fed.

The symptoms of the acute type are nausea and vomiting, pain colicky in character with marked tenderness over the upper abdomen which in time becomes distended. There may be free fluid in the abdominal cavity.

The symptoms of the chronic type are of more gradual onset and are accompanied with emaciation although the upper abdomen will gradually protrude in marked contrast to the abdomen containing ascites wherein the lower abdomen protrudes. Indigestion is marked in these cases and usually accompanied by a fermentative diarrhea. Pallor becomes pronounced and there is an accompanying fever of a few degrees. In many cases, there is marked enlargement of the cervical glands.

The von Pirquet test is of value in these cases. The diagnosis is based on the finding of the enlarged lymph glands, the protrusion of the upper abdomen, pain on pressure in the epigastric region.

The general management of these cases consists of feeding certified milk from tuberculin tested cows, or better still, from goats, and if unable to obtain this, pasteurized milk. In either case a few drops of cod-liver oil should be added to the milk. Cleanliness, fresh air, and all the sunshine possible should be insisted upon. When exposed to the sunshine, the less clothing the better, although the head should be protected from the midday sun.

The treatment of these cases is mainly physical therapy. Heliotherapy is good if it can be had as in warm climates. In any climate and at any time of the year, phototherapy can be used and is the treatment of choice in all of these cases. Strip the child of all clothing and leave it under the visible light for an hour or more daily; follow this with the actinic rays from the air-cooled lamp for one to ten minutes daily. If any of the glands become necrotic, they should be lanced. It is not necessary to excise them; simple lancing is all sufficient. Extra treatment of the enlarged glands with the water-cooled quartz lamp is of value. Use enough to produce a good hyperemia. Under this treatment laparotomy will seldom be called for. Stimulating doses of radium may at times be beneficial and should be remembered.

The actinic-ray treatments should be given daily for at least one month, then less frequently for two to four months longer and with proper feeding are usually all that is necessary.

Iodide of lime is at times of value given in small doses once or twice daily.

The average length of time the case will require treatment will be from three to six months.

The prognosis is good under this treatment. See Plate LX.

Telangiectasis.

Telangiectasis is usually characterized by small veins and arterioles developing in scar tissue. The condition is progressive.

The etiology is almost invariably scar tissue, the result of X-ray or radium treatments. Only infrequently does it develop in other scar tissue. Men and women of advanced years frequently develop small raised spots upon various parts of the face, neck, and body, varying in size from one-sixteenth to one-fourth of an inch in diameter. These are little groups of dilated capillaries usually red in appearance and require treatment for cosmetic reasons only.

Telangiectasis is usually symptomless, although when occurring after X-ray or radium treatment and especially if the blood vessels are forming and dilating rapidly, it may produce a creeping or crawling sensation under the skin which is extremely distressing to the patient.

The diagnosis is usually easy if one will remember that these conditions have an appearance very similar to that of the small silk threads in a United States greenback.

Only two methods of treatment are recommended for this condition and these are the Oudin current and actinic rays. For the larger areas, very small sparks from the Oudin current just sufficient to desiccate the blood vessel itself, affords immediate relief. For the larger areas and smaller blood vessels, actinic rays from the water-cooled lamp, used at a distance of about one-half inch for one to three minutes, just sufficient to blister the area, usually produce an endarteritis sufficient to obliterate these smaller blood vessels, and what is more important, thins out the scar and makes it more pliable and elastic. These treatments should be continued at intervals of from one to two weeks until distinct improvement occurs sufficient to satisfy either the practitioner or the patient, or both. However, it must be remembered that not every little blood vessel can be removed; neither can all of the scar tissue be removed, thus there is liable to be a recurrence in after years, although the results are very satisfactory. The skin will not be normal in either appearance or texture, but approximates both.

The prognosis is good.

Tenosynovitis.

Tenosynovitis may be either acute or chronic and although it may be due to injury, the chronic case is usually a tubercular lesion anterior to the wrist. The acute tenosynovitis may accompany any of the infective inflammatory diseases as a complication. Gonorrhea and syphilis are listed as etiological factors.

The cardinal symptom is inflammation of the tendons, with crepitation along the tendon sheath as soon as the pain appears. This disappears to some extent as the disease progresses and particularly so if suppuration takes place. Mixed infection may take place from without or be blood born, particularly if the tissues are badly crushed or damaged below the integument. This acute type is a common accompaniment of felons.

These cases must be differentially diagnosed from osteomyelitis, periostitis, injury, or from arthritis due to infection or accompanying rheumatic disorders; however they are acute and usually develop into very painful infections the first twenty-four or forty-eight hours.

When the tendon sheaths are infected, the tension within the tendon sheath creates an excruciatingly painful condition, demanding immediate treatment, which should be surgical. Open the abscess cavity and make allowance for sufficient drainage for the slough or core, which will come away in a few days. The only drugs useful in these cases are sodium iodide, 32 grains, and guaiacol, $\frac{3}{4}$ of a grain intravenously. Aluminum acetate, boric acid, or magnesium sulphate in a saturated solution may be used locally as wet dressings. After the slough has come away, it may be well to use a ten per cent solution of oleum terebinthinae in oleum olivae as a dressing. This keeps the wound clean and sterile and prevents adhesions of the dressings to the granulating tissue.

Physiotherapy offers much for these cases, and as soon as lanced they should be given general treatment with visible light and actinic rays over the extremity, and treated locally with the water-cooled lamp over the infected area. This will usually tend to limit the spread of the infection after the first treatment and hastens its healing but first and foremost these cases must be opened, chiefly to prevent the spread of the infection along the tendon sheath to other parts of the extremity and to prevent infection spreading to other parts of the body.

The average length of time these cases will require treatment is from a few days, if seen early, to a few months if seen late, particularly if they are accompanied by an osteomyelitis.

The prognosis is usually good if properly treated. Untreated cases may develop pyemia and end fatally.

Tenosynovitis, Chronic.

While the chronic tenosynovitis may follow the acute and have the same etiological factors, the fact remains that the majority of these cases are tubercular. An additional factor in clearing up the diagnosis of these cases is that most of them develop on the tendons about the wrist. There is very little or no pain until the mass becomes large enough to cause pressure symptoms. It usually has a doughy feeling much like that of a lipoma, with this exception: small tubercular masses form in the general mass, giving it the sensation of boiled rice when the mass is palpated. The condition is usually found on the anterior portion of the wrist, and the doughy mass may be the first indication of any disease process.

The cardinal symptom of this disease is the chronic thick doughy mass under the skin which is adherent to it, with small

nodular masses in the larger mass, which are soft. There is no ulceration, no redness of the skin, and no edema.

The earlier these conditions are diagnosed the better the result of the treatment, which may be surgical for the removal of the mass, and if this is done it must be thoroughly done, for if one of these little tubercular masses remains within the tissues the disease will tend to recur. Drugs offer little or no help in these cases, but physiotherapy offers much. The use of actinic rays from the water-cooled lamp at a distance of one-half inch for a period of from one to five minutes over the entire area is of value. This will blister the skin heavily, but will tend to cause destruction of the bacteria and absorption of the mass. However, if no definite benefit is obtained after ten treatments, this method should be discontinued for surgery, but following surgical treatment the case should again be treated by actinic rays to prevent recurrence. Many of these patients are of low vitality and will require general visible light and actinic rays in addition to the local treatment, for the general treatments themselves will not be sufficient for the local lesion, per contra the local treatment will not be sufficient for the general condition.

The average length of time these cases will require treatment will be several months.

The prognosis is usually good, as the disease is of very slow growth.

Tetany or Spasmophilia.

Tetany or convulsions in infants and children are usually the result of the absorption of toxins and are closely associated with the underlying etiology of rickets. However in diagnosing this condition, it must be remembered that many cases of convulsions are due to injury either during child birth or afterwards, to meningitis, brain tumors, hemorrhage, and may accompany all infectious diseases and croup. It may be due to drug or mineral poisoning and of course many cases are due to major or minor epilepsy.

Tetany must be thought of in diagnosing convulsions. The etiology is unknown, although Howland reported that the blood calcium had been found as low as 3.5 mg. per 100 cc. of serum (normal 10-11). In convulsions due to other causes than tetany he did not find a reduction of blood calcium. An infant suffering with tetany may have a normal blood phosphorus.

Weeding out the more severe diseases which are accompanied by tetanic contractions or convulsions and taking up the more simple diseases in which convulsions are found in the great majority of cases, and we have those which may be classed under the head of toxemias, closely associated, as they are, with malnutrition.

The most common site of the contractions is the upper extremities, although all muscles may be involved in severe cases.

The duration of the attack is variable from hours to days with recurrence at any time.

Their general management will require the best hygiene possible, rest during the period of convulsion, graduated exercise in the open during the intervals, a diet suitable to the individual, which, if an infant, should be mother's milk first, but if this is not obtainable, then use cow's or goat's milk, properly modified. The bowels must be regulated so that the child has from one to three bowel movements daily. On the other hand, all tendencies to diarrhea or dysentery must be controlled.

In these conditions, there is no surgical treatment and drugs have but little effect unless one classes cod-liver oil as a drug, although in reality it should be classed as a food and should be given for its nourishing qualities.

In infants and children, it is hard to give cod-liver oil by mouth because of its disagreeable taste and its liability to produce nausea and vomiting; therefore for infants it is best to use it by inunction over the entire body and in this way from one-half to two ounces can be absorbed each twenty-four hours. It is surprising to see what it will do for these little folks. In addition to the inunction of cod-liver oil—and it matters not whether the child is constipated, diarrheic or dysenteric, whether the stools are white, yellow, green, frothy, or bloody—actinic rays are the best method of treating these cases.

For the little folks, give a visible-light treatment of ten minutes to one-half hour at a distance which is absolutely comfortable to the child. This will help eliminate many of the toxins through the skin, thus putting less work upon the kidneys and bowels. It helps to maintain body warmth, thus avoiding the overuse of food for heat production, and lastly, and the most needed of all, it produces temporary dilatation and brings the blood to the surface of the body, after which the child should be given an actinic-ray treatment from the air-cooled lamp at a distance of about twenty-four inches, beginning at about one-half minute and increasing one-half to one minute a day, according to the reaction of the skin, until eight minutes are reached, then continue at this period. The distance is gradually decreased to about fourteen inches. If one has not seen these treatments given and the results obtained, they will certainly be surprised to see the child's general condition, nutrition and appearance change within a few days.

As pointed out by McCollum in 1908, the calcium and organic phosphorus metabolism is interfered with, so they should be replaced temporarily, at least, by drug administration. Many times the cod-liver oil as already given is sufficient, particularly for the restoration of the phosphorus and to aid in the restoration of the

calcium balance. Calcarea carb. or calcerea phos. in very small doses—1/1000 of a grain three times a day—will aid materially. Parathyroid in very small doses is at times invaluable. Calcium chloride frequently gives prompt relief.

These treatments should be continued until the child is in as perfect health as it is possible to obtain, giving daily treatments until there is very definite benefit, then three times a week, twice a week or once a week, as needed, for weeks or even months.

Eliminating all serious illnesses which have been given in the etiology with which convulsions are an accompaniment, the prognosis is usually good, provided the above treatment is given.

Endocrine dysfunction should be sought for, particularly parathyroid.

Thymoma.

Thymoma may be briefly described as any enlargement of the thymus gland. It is frequently found in infants and infrequently found in adults. In the latter it may be as a regenerated thymus or as a malignant thymus. It is somewhat questionable if a regenerated thymus occurs after the twentieth year and if cases are seen in the thirtieth year or after, they are probably, in the vast majority of cases, malignant, either carcinomatous or sarcomatous.

The cardinal symptoms of the infant are short, difficult inspiration with slight cyanosis, feeble cry, restlessness, difficult nursing, inanition and retarded development. There is a definite increase in the size of the gland during a crying period.

Differential diagnosis. Thymoma must be differentiated in children from diphtheria, laryngitis, compression of the trachea by other neoplasms, particularly from thyroids growing in the upper mediastinum, adenoids, malformations and foreign bodies lodged in the air passages.

The cardinal symptom of the adult patient is what is usually termed thymic-asthma, which is a peculiar dyspnea not wholly unlike that of edema of the larynx in which the individual is unable to inspire a sufficient quantity of air for the needs of his activities. On the other hand, thymic dyspnea is more pronounced during mental excitement than during physical exertion. The usual accompanying symptom is a slight coughing from a sensation of pressure or choking. However, for a final diagnosis of these cases roentgenograms should be depended upon. The growth fills the superior mediastinum, which differentiates it from lymph gland enlargement in the middle third of the mediastinum. Only occasionally can the growth be palpated, although they usually hug the anterior wall of the thorax and are non-pulsating.

The general management of these cases is not so important as the radical treatment, which should be at the earliest possible moment.

Either X-ray or radium should be used over and at the sides of the upper third of the sternum. If radium is used, it should be in fifty milligram packs with $\frac{1}{2}$ millimeter of brass, 1 millimeter of lead, and 2 centimeters or more of leather, or $2\frac{1}{2}$ centimeters of wood. These packs should be applied for one to four hours, preferably over the border of the enlarged thymic gland. In adults the dose should be two such packs applied on lateral borders of the thymus for three hours, when it should be shifted to the opposite borders for a like period of time. If the enlargement is due to a malignancy, it may be necessary to repeat these treatments several times, at intervals of three to six weeks. The effect of the gamma rays are so definite—many times in a few hours—that other treatments should not be considered for these lesions.

Case No. 58. Male, age 35. Was referred to me on July 19, 1924, for a difficulty in respiration which consisted of a peculiar sighing with inability to complete the inhalation. These attacks were made worse by any excitement and by fatigue.

X-ray examination revealed a tumor in the upper mediastinum. When congested it pressed upon the lower trachea and upper bronchia (see roentgenograms).

There was a palpable tumor behind the upper sternum and pressure upon this tumor aggravated the difficult respirations.

His treatments consisted of radium packs over the margins of the tumor. These packs contained 50 mg. of radium and the treatments were 3 hours in duration. He had six of these treatments in the course of twelve months with complete relief of symptoms.

DIAGNOSIS: Thymoma.

Thiersch Grafting.

First have a healthy granulating surface rendered sterile by an actinic-ray treatment of a minute's duration.

Second, sterilize the area from which grafts are to be taken.

Third, wet the surface to be grafted with normal saline solution.

Fourth, remove the graft by picking up the skin with a needle and severing it with a sharp scalpel just deep enough to start bleeding.

Fifth, dip the graft into normal saline solution and place it on the granulation tissue one-half inch apart, using enough grafts to cover entire area in this way.

Sixth, use no dressing in contact with the grafts.

Seventh, have nurse drop normal saline solution over grafts hourly for twelve hours, then every two hours until grafts are well attached.



Thymoma. Patient aged thirty-six.



Thirty days after first radium treatment.



Seven months after first treatment.

Eighth, after the first twenty-four hours give a few flashes of actinic rays from the water-cooled lamp daily over the entire area.

Ninth, after the third day use magnesium sulphate, one dram to the pint of sterile water, to keep the area moist in the place of the normal saline solution.

Tenth, after the grafts begin to grow change the magnesium sulphate solution to a ten per cent solution of oleum terebinthinae in oleum olivae, after which dressings may be applied, usually about the seventh day.

Eleventh, up to this time use a wire splint cage to keep all dressings from coming in contact with the grafts.

Twelfth, after the tenth day use visible light for ten minutes daily, preceding the actinic-ray treatments, which may now be lengthened. From now on continue the visible-light and actinic-ray treatments until healing is complete and for some time thereafter.

Tinea Favosa.

Tinea Favosa is a fungus affliction of the scalp and is usually chronic. Vesicles form at the edge of the lesion, which in turn ooze and form scabs, and when these are removed, there is a cup-shaped depression in the skin which, when healed, produces scars and atrophy. The hair in the lesion has the appearance of having been eaten off and resembles a stubble field.

The etiological fungus is the *achorion schönleinii*. Examine the hair and discharges for the mycelium. These vegetable organisms are transferable from man to man, therefore the disease is infectious.

The pathological lesion is the destruction of the superficial and middle layers of the skin.

The differential diagnosis will be from other vegetable parasites and chronic furunculosis. The latter, however, seldom attacks the hair and does not leave the stubble field appearance of vegetable parasites.

The general management of these cases consists in cleanliness.

As to the treatment of this condition, parasiticides may be used, but the best treatment is either X-ray or actinic rays. The X-rays are a valuable therapeutic agent and destroy the vegetable parasites, but they may also destroy the matrix and thus produce a permanent alopecia. The actinic rays from the water-cooled lamp will destroy the fungus and stimulate the hair growth, the very opposite of the X-rays. These treatments should be given with the lamp at a distance of one-half inch for one to three minutes three times a week until scabs cease to form, then once a week. X-ray and actinic rays are all that are necessary for the relief of this condition.

The average length of time that these patients will require treatment will be from two to four weeks.

The prognosis is good, although at times there is a tendency to recurrence unless every parasite is destroyed.

Tinea Trichophytina (Ring Worm or Barber's Itch).

Trichophytosis or ring worm is a contagious fungus disease of the hair and hair follicles, as well as the nails and epidermis.

The etiology is a microscopic vegetable fungus under the name of the trichophyton. It gathers its modifying titles by appearing on the various parts of the body or about the nails. When upon the beard it is commonly called barber's itch, upon the face or other parts of the body it is commonly known as ring worm. All have the same etiology.

The pathology is the burrowing of the mycelium along the hair shaft into the follicle and thus throughout the deeper layers of the skin carrying with it a mixed infection and abscess formation.

In diagnosis it must be differentiated from other skin diseases having eruptions or scab formation.

The general management of these cases will consist in preventing a spread of the infection otherwise it has little to do with the treatment. The disease is spread by use of towels, soap, wash cloths, etc. The individual suffering with it must protect others by having individual towels, soap, and wash cloths.

In the treatment of these conditions, drugs have but little effect although occasionally iodine to the point of blistering, especially in the early stages of ring worm, will stop the growth of the fungus. However in physiotherapy we have the best means of treating these cases and that is with the actinic rays from the water-cooled lamp given at a distance of one-half inch for a period of one to three minutes which usually stops the growth the first treatment. However, if the case has been running for several weeks and the deeper tissues are involved together with abscess formation, several weeks will be required to clear up the case. Not only the diseased area itself should be treated but the surrounding area to prevent the spread of the infection.

If it is seen early, many times one treatment is sufficient to stop the growth and clear the case. The most severe cases should be treated daily until all the scabs are removed then every second or third day until healing is complete.

X-ray may be used for these cases with very decided benefit, however, it must be prolonged to its epilatory action. As X-ray removes the hair more or less permanently, actinic rays from the quartz-mercury lamp should be used in its place particularly if the fungus is growing in the hair of the scalp.

The prognosis is good.

Case No. 95. Male, age 34. Was referred for treatment

September 8, 1923, at which time he gave a history of skin infection which started seven weeks previously.

At this time the infected area covered all of the left side of the face and part of the right side. In appearance it was pustular and covered with heavy scabs.

His first treatment with the water-cooled actinic-ray lamp was of three minutes duration. Two days later a portion of the scabs was removed and a second treatment of three minutes given. His treatments were given every second day and were of like duration. There was no further spreading after the first treatment and all surfaces healed after ten treatments.

His five year old daughter was infected by him. The infection on her scalp covered an area of about two inches in diameter. Five treatments of two minutes each were sufficient to heal this lesion.

DIAGNOSIS: *Tinea Barbae*.

Case No. 595. Female, age 21. Came to us Jan. 17, 1922, at which time there were four bare spots on her scalp, one about two inches in diameter, the others smaller. Each area was covered with branny scales and stubbles of hair and raised spots in the scalp.

Her first treatment was on May 17, 1922, and consisted of a two-minute exposure with the water-cooled quartz mercury-vapor lamp at a distance of one inch. The second and third treatments were a like exposure on the 23rd and 26th of January. The fourth and last treatment was February 3rd and was for three minutes. At this time the hair had started to grow on the bare spots and there was no sign of further trouble.

DIAGNOSIS: *Tinea Tonsurans*.

Tonsils Hypertrophied.

Hypertrophied tonsils may be treated by total surgical excision, at which time it is best to free the pillars by dull dissection from the tonsil, then using a Tyding snare for the enucleation of the base. This can be done under either a local or general anesthetic and is the treatment of choice, particularly in children. However, many of these cases can be treated with actinic rays from the water-cooled lamp. These treatments should be given daily for acute hypertrophies, and twice weekly for chronic hypertrophies, and are given through a tubular applicator, cross firing the throat for the most thorough application and so the operator may have a clear vision at all times of the part being treated.

The length of time of these treatments should not exceed two minutes for each tonsil, and one minute is usually all that is necessary.

Case No. 165. Female, age 4. Was referred for treatment August 16, 1923. Examination revealed enlarged tonsils from which caseous masses could be pressed. Her parents refused opera-

tion so she was treated with actinic rays from the water-cooled lamp every 4 or 5 days for the next two months, at which time her general health had improved markedly and the tonsils were clean and normal in size.

Each treatment consisted of a raying of one minute over each tonsillar area. The applicator was held about 1 inch from the pillars.

DIAGNOSIS: Hypertrophied Tonsils.

The Treatment of Tonsils With High-Frequency Currents.*

"High-frequency currents as they are used today are of three types: Tesla, d'Arsonval, and Oudin. A detailed description of each type is not necessary at this time. The Tesla is least adaptable, hence little used. The d'Arsonval (bipolar) from a properly constructed machine is very easily controlled, and therefore lends itself readily to the treatment of pathological conditions in cavities and is the current of choice in most cases. The Oudin (unipolar) is at times preferable, usually where superficial action alone is required.

While these currents are adaptable to the treatment of the pathology of many tissues, for the purposes of this article I shall confine myself to the tonsils alone. As the many different pathological conditions of the tonsils are given in detail in all standard text-books, they need not be repeated here. For the sake of simplicity and brevity, my remarks will be limited to the simple hypertrophied, the benign septic, and the malignant tonsil.

To begin with, the use of the high-frequency currents as a destructive agent is a surgical procedure which demands the same knowledge of anatomy, physiology, pathology, and surgery required to perform a cutting surgical operation. That it can be done bloodlessly, in very much less time, and with very little shock or post-operative reaction does not alter the above dictum. This method of treatment does not lend itself to the treatment of patients under twelve years of age because the noise of the current frightens them, and because it is impossible to use it with ether anesthesia, for the spark will explode the ether.

For benign conditions, we use any of the recognized local anesthetics in an average 2 per cent solution. Cocain is entirely excluded. The solution should be injected into the base of the tonsil and peritonsillar tissues to alleviate the sensation of heat produced by the resistance of the tissues to the passage of the current, for thus it is that the tissue is destroyed. The needle applicator does not become hot.

The machine used for the above purpose should be capable of developing at least 2,000 milliamperes. This amount will not be

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needed, but one should have a reserve supply of energy for any emergency. Usually we use about 500 milliamperes of d'Arsonval current.

For the indifferent electrode use the autocondensation handle and have the patient hold this in both hands; no wetting is needed. To the other pole of the machine attach a good flexible conducting cord of sufficient length to reach all parts of the throat without tension. To this conducting cord fasten a good, hard rubber handle of convenient size and length, capable of firmly holding a pliable needle of sufficient length to reach the tonsil readily. If one desires to insulate a portion of the needle, a piece of rubber tubing is sufficient. This needle applicator should be as sharp as possible to confine the action to a small area. The metal we prefer is aluminum.

The tongue is held down with a depressor of any non-conducting material. Wooden tongue depressors are usually sufficient. A good foot-switch is a necessity, so the operator has absolute control of the current at all times.

The actual treatment is as follows: Anesthetize the tonsil and peritonsillar tissues; set the high-frequency machine to deliver about 300 milliamperes of d'Arsonval current, which is sufficient for simple hypertrophies (use about 600 milliamperes if destruction is desired); have the patient sitting where a good light can be thrown into the throat; have the foot-switch at a convenient distance, one pole of the current going to the patient's hands. Now with your needleholder and tongue depressor you are ready for the treatment. If mere reduction in size is wanted, place the needle on the tonsil and step on the foot-switch, watching carefully the action on the tissues. As soon as the tissues commence to blanch, stop and move the needle to a new place and proceed as above until all areas are equally treated, at which time the patient is ready to go about his regular duties.

However, if you wish to destroy the tonsil, use the stronger current and insert the needle into the tonsil tissue about one-fourth inch; then proceed as before, again watching for the blanched appearance which will take a slightly longer time (a few seconds) and will mean that the tissue around the point of the needle has been coagulated and destroyed. Now reinsert the needle into a new area and continue until the desired destruction has been accomplished and your patient can resume his occupation.

The destroyed tissue will come away in about ten days of its own accord. Do not attempt forcible removal or you will start bleeding. One treatment is usually sufficient; however, if not, another can be given a month later. The actual working time for both tonsils should not be over five minutes.

The postoperative care is the same as that after a cutting tonsillectomy. Personally, we use a water-cooled quartz-mercury

lamp (actinic rays) for postoperative sterilization. Most of these patients are not confined to the hospital or their homes, but can go about their daily occupations with no further disturbance than a slightly sore throat.

Quite a different proposition confronts us when dealing with a malignant tonsil. Here a general anesthetic is required, and ether being out of the question, we were compelled to develop another method. Therefore, for several years I have given one-fourth grain of morphin sulphate and one-hundredth grain of hyoscin hydrobromate hypodermatically one and one-half hours before operating, repeating the same dose three-quarters of an hour later. If the patient is able to answer questions when brought to the operating room, enough ether is poured to obtain complete narcosis. Then everything pertaining to the administration of the ether is removed from the room. This dose has been found to be safe for the average adult in average health. We have employed this anesthesia with patients of all ages, from 16 to 82 years, without any bad results. We use only one dose one-half hour before operation in the age extremes. This anesthetic, like all others, requires common sense and a general knowledge of anesthesia to make it safe.

Now we are ready to proceed as with the benign tonsil except that we place the indifferent pole (composition metal, 10 inches square) on the patient's back and use about 1,500 milliamperes of current, totally destroying not only the tonsil but, if necessary, the pillars and a large portion of the soft palate, tongue, and floor of the mouth. When this slough, which is heavy, comes away, we follow with radium or X-ray, or both, to reach surrounding tissues and metastases. This extensive work is *just as bloodless* as in the benign cases, but these patients require hospitalization until the slough has been removed.

In all our cases, now numbering several hundred, we have never had an edema of the glottis, seldom an edema of the pillars or soft palate, seldom use morphin postoperatively because there is very little pain and very little difficulty on swallowing. The amount of sloughing depends upon the amount of destruction. In malignant cases, the pain suffered before operation is markedly diminished by the time the patient recovers from the anesthetic.

CONCLUSIONS.

1. Electrocoagulation is a surgical operation.
2. It is bloodless.
3. It relieves more often than it causes pain.
4. If properly done there is very little reaction.
5. Toxemias are relieved rather than produced.
6. Dosage is controlled by the operator's knowledge of the existing pathology.
7. Dosage can be so well controlled that surrounding tissues need not be damaged.

8. Scars resulting from this treatment are soft and pliable.
9. Postoperative bleeding is rare and readily controlled.
10. Experience is necessary to obtain the best results."

Tonsillitis.

Tonsillitis may be either acute or chronic.

The etiology in either case is an infective organism in about the following order according to frequency: streptococcus pyogenes, streptococcus viridans, streptococcus hemolyticus, pneumococcus, staphylococcus albus, or pyogenes aureus, and occasionally a colonic, diphtheric, or tubercular bacillus infection.

The pathology is a definite increase in the parenchyma cells enlarging the gland, the crypts of which are filled with an exudate of caseous matter or food particles with a mixture of ciliated epithelium, leucocytes, lymphocytes, and bacteria. If this goes on for any length of time the condition becomes chronic, fibroblasts appear changing portions of the parenchymatous tissue to fibrous.

The cardinal symptoms are always a sore throat, foul breath, accompanied, in the acute cases, by chills, fever, and aching more or less throughout the body, particularly the back and limbs, and a general malaise. Temperature and pulse are both increased, the former between 101° and 104° F.

DIAGNOSIS: Different types of inflammation of the tonsil must be considered as simple, tubercular, or syphilitic infection, diphtheria, Vincent's angina, scarlet fever which always starts with a sore throat, etc. Usually small white or yellow spots which are separated from each other will be sufficient to differentiate the acute follicular tonsillitis from diphtheric, which has as its characteristic a grayish membrane with indefinite edges. It must be remembered that whatever type of bacteria infects the tonsil that same type will be found in the mucous membrane of the pharynx, nose, and accessory sinuses.

The treatment of these cases will depend upon the severity of the symptoms. While the milder cases may be ambulatory, the more severe cases must be put to bed. This is particularly true of the diphtheric type which should be strictly quarantined. These cases are all infectious and should be separated if possible from other members of the family. The diet should be light or what is better a fast for one or two days. The bowels should be kept free. Frequently an ounce of castor oil for an adult dose clears up many of these symptoms by freeing the bowels of toxic material. Usually the symptoms of diphtheria are much more severe and the characteristic smooth membrane with margins which cannot be definitely located will be seen growing on the tonsil or the surrounding mucous membranes. If watched a few hours, it will be found to be spreading slowly but surely. This with the peculiar mousey odor of the breath should clinically clear up the diagnosis in the early stages. However, in all suspicious cases, smears and cul-

tures should be made and the case quarantined until a definite diagnosis is made.

In the treatment of acute tonsillitis, surgery is not called for unless there is tonsillar or peritonsillar abscess (quinsy) when it must be drained. As a rule, this can be done through the mouth. If, however, the infection extends into the deep cervical glands, the drainage should be established by incision from the outside, going posterior to the sternomastoid muscle and working down beneath it (by dull dissection) to the abscess which will involve not only the deep chain of cervical lymphatics but, at times, the surrounding tissues.

Drugs have their place in the treatment of acute tonsillitis. For internal medication those of most value are belladonna, ferrum phos., gelsemium, aconite, and camphor. Intravenously sodium iodide 32 grains and guaiacol $\frac{3}{4}$ of a grain give the best results. Locally, we have seen but little benefit from any drug treatment although magnesium sulphate as a wet dressing gives some relief. Physiotherapy offers much for these cases in the use of actinic rays from the water-cooled lamp which should be directed over the mucous membrane of the pharynx as well as the tonsils for a period of one to two minutes daily.

Complications which may occur from these cases are infections of the eustachian tube and middle ear, peritonsillar abscesses, acute or chronic rheumatism, chorea, arthritic endocarditis, pericarditis, and nephritis. Only occasionally will skin eruptions appear and these are usually associated with a syphilitic tonsillitis or scarlet fever.

The average length of time a case of acute tonsillitis will require treatment is from two or three days to a week.

The prognosis of these cases is good.

For the case of chronic tonsillitis one has only two methods of treatment to choose from that are worthy of consideration. It goes without saying that these cases should be built up in general health as much as possible. They should live in the open, have an adequate diet, the bowels should be kept free which will do much for the general condition of the patient, although it may do but little for the local condition.

For local chronic infections of the tonsil, surgery in some form offers the best treatment for its eradication. Personally we consider the complete enucleation of the tonsil by the Tyding snare—after the pillars have been loosened—the best method; however, many of these cases can be entirely relieved of their infection and symptoms by the use of the water-cooled actinic-ray lamp. The rays should be directed over the tonsils, pillars, and mucous membrane of the pharynx at a distance of one-half to one inch from the end of the applicator, and the treatments should be given two or three times a week for several weeks. Before starting this treat-

ment, however, one should remove all caseous matter from the crypts, and this should be repeated at least once a week while the case is under treatment. This clears the tonsil of its gross infection and aids materially in shortening the length of time it will be necessary to treat these cases. This method is painless and therefore is applicable to both children and adults.

Use a small tonsil applicator or a tubular applicator which confines the rays to the tonsil and pillars; however, as the surrounding mucous membranes are usually involved in the infective process, they should also be rayed lightly by the actinic rays, and this makes an ideal post-operative treatment after the tonsillectomy.

Enucleation of infected tonsils does not reach the surrounding lymphoid tissue, which many times contain as much infection as the tonsils themselves.

If these treatments are given daily in the acute cases or three times a week in the chronic cases, many of them can be restored to normal without surgery. If for any reason it is impossible to remove them surgically, this treatment should be given a trial. In addition to actinic rays, where it is desired to destroy badly infected tonsils or those with large crypts which may constantly refill with caseous material or food, and where it is desirable to destroy the tonsil by other than cutting surgical measures, electrocoagulation, which can be done in one's office under a local anesthetic is to be considered. See article on The Treatment of Tonsils with High-Frequency Currents.

Tuberculosis.

In outlining the treatment of tuberculosis by physical methods I do not expect to give you much that is new; neither do I expect to throw aside those things which are of proved value, such as sunlight, good food, rest, and cleanliness; but rather to emphasize these, and in so doing give particular emphasis to the use of heliotherapy from artificial sources. Sunlight is the first essential in the recovery of the tubercular case.

Good food is a close second, but it is my desire to enter a protest against the stuffing process which has been in vogue for some time. Stuffing a tubercular patient will upset an already disturbed stomach, and with the stomach disordered there can be but little hope of recovery; hence urge the patient to eat all that he can digest properly and no more. He should eat frequent small meals rather than a few large ones.

All of the oils and fats that can be properly digested should be taken, but no more. Butter-fat is without doubt the best, followed closely by cod-liver oil, olive oil, and bacon. It matters but little how these foods are taken; they may be cooked with other foods or taken separately. A large part of the butter eaten should,

however, be taken unheated and spread on whole wheat or bran bread. Rye bread is only slightly less valuable than whole-wheat or bran. At least a heaping tablespoon of bran should be eaten daily, either by itself or mixed with other food.

Next in order come the uncooked vegetables, from which is obtained the exceedingly minute but *invaluable vitamins*, some of which cooking destroys—as in lettuce, Chinese celery, watercress, celery, cucumbers (without salt or vinegar), radishes, tomatoes, onions, carrots, cabbage, melons of all kinds (especially the honeydew), grapes (which are much vaunted as a cure), as well as all non-acid fruits.

Cooked fruits come into the diet of the tubercular along with the cooked vegetables, and chief among these are prunes, peaches, apples, pears, plums. Among the cooked vegetables should be mentioned beets, string beans, carrots, onions, eggplant, Brussels sprouts, squash, pumpkin, parsnips, asparagus, spinach and all greens, sauerkraut, and potatoes (with their skins, either boiled or baked). All water in which these vegetables are cooked should be saved to add to other cooking, best of all to soup stock, for in this water is a most valuable food element, the mineral salts, which are extracted in the cooking but not destroyed, and when thrown away are wasted. While the mineral salts are in minute quantities when compared to the starches, carbohydrates, and fats, yet it is impossible to remain well or regain good health without them. Chief among the extracted mineral salts stands potassium, which is necessary for growth and health.

Eggs and milk are excellent in most cases but must not be pushed where they disagree. Bulgarian milk will disagree less than sweet milk.

Lastly come the heavy starches and meats. Among the heavy starches are brown rice, whole wheat, beans (lima, navy, etc.), cornmeal, oatmeal, buckwheat, macaroni, spaghetti, dried peas, and bananas. These heavy starches are essential to the upbuilding and upkeep of the human body, but the tubercular should use them sparingly until his improved digestion will properly care for them. At all times they must be well cooked, *which means hours*. Oatmeal, for instance, should cook steadily for six or eight hours, or until it becomes a jelly. When in this condition the starch is thoroughly converted and even a delicate stomach will digest a fairly large quantity of it. Wheat or corn coarsely ground, stirred into boiling water and cooked two or more hours is also an excellent food for the tubercular patient.

Meats, except bacon or fried salt pork, should come last in the tubercular's diet, and then in about the following order: wild game, chicken, mutton, beef, pork (other than salt pork or bacon). While cheese ranks about on a par with pork in the tubercular's

diet, small quantities of aged cheese may be used as an aid to digestion, but large quantities should be avoided. Fish of all kinds is a splendid article of diet for the tubercular patient. Fresh fish is best for steady diet, but salt or smoked is at times a splendid appetizer.

No condiments, spices, pickles or other articles of diet which are vinegar-soaked should be used.

The tubercular patient must have plenty of fresh, pure air, and he must get it as nature gives it, not artificially heated, and he should have it for the full twenty-four hours of each day.

Next in order is rest; and here, as with forced feeding, we think the pendulum has swung too far. Rest is good for the tubercular case when the fever is high, 101° F. and over, but to put a patient to bed and keep him there when it is 100° F. or under is in the vast majority of cases not only unnecessary but harmful, and it is particularly harmful if he is told to take his temperature every two hours and keep a record of it, for he can readily worry himself into a temperature of 100° F. or even higher. A system of treatment which puts the patient back into his regular occupation as soon as possible, even if the temperature does rise to 100° F. or higher during the afternoon, provided the occupation is not too detrimental to his health, is to be recommended. The fact is recognized that the patient should work outdoors, but in large cities this is seldom practicable. Employment gives him the financial assistance he so often needs, and thus his mind is diverted from himself and his diseased condition.

Another reason why it is thought best to keep the tubercular patient at work, is that after six months or a year of absolute idleness which has been forced upon him with daily injunctions that he must not exercise, he is firmly anchored to the thought that he cannot work and it is difficult for him to again take up active pursuits.

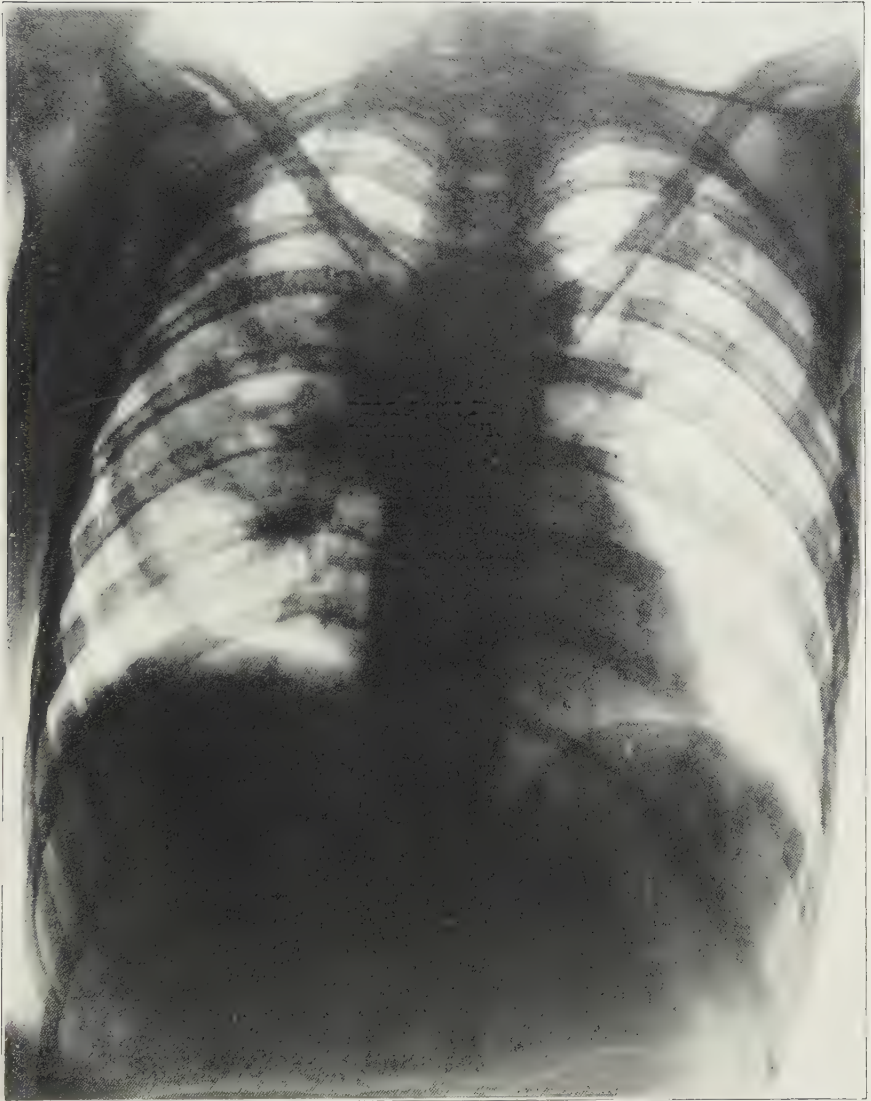
A third reason why absolute rest should be recommended with caution is that absolute rest of body for the tubercular means an overactive mind, for the tubercular (except in the last stages) is very active mentally, and if his mind is not occupied with pleasant thoughts it will be occupied with unpleasant ones, such as the precarious financial conditions of his family and his own physical condition, which are ever-present worries of the large majority of these cases. For these reasons and many others it is thought best not to disturb the daily routine of these patients, if it can be avoided, and, where absolutely necessary to disturb it, to do so as little as possible and for the shortest period of time. Do not let him become a parasite and reach the stage where he feels that he is an invalid and should make no effort to help himself. The man who is willing to fight for his living is willing to

fight for his life, and when he reaches a state of mind where he is not willing to put forth his uttermost to get well, there is no system of treatment on earth that will help him.

An arbitrary standard of how much work each patient should do cannot be established. A sufficient standard, both as to temperature and amount of work to be done by him, is that he continues to improve both as to temperature and strength. If his sense of well-being increases, if his appetite and digestion are good and his bowels regular, if he sleeps well, if his temperature continues to drop, if his coughing spells grow less violent and less frequent, and if he is gaining or holding his own in weight, we can safely assume that he is progressing satisfactorily—and this without daily examination of his chest, which should not be done more than once in every two weeks unless some untoward symptoms arise, for the reason that too frequent examinations keep him unduly alarmed. These cases are already filled with fear from what they have read and because of what they have been told and are constantly being told by their friends and relatives, and at times by their doctor, regarding the incurability of tuberculosis. Because of these things, the first effort is to eliminate their fears and replace them with hope. Destroy a man's hope of recovery—and the Lord help him.

Our next emphasis is laid on cleanliness, both of living conditions and of body, and the latter cannot be had without the former. These cases perspire freely and therefore must bathe frequently with good soap and water, and in addition to this a cool sponge bath of magnesium-sulphate solution (1 to 16) should be taken on rising and on retiring. It is exhilarating. This cold sponge can be given several times a day if the fever is high.

In giving physical-therapy treatments to tubercular patients, everything above outlined has been done. They are kept out-of-doors in the sunshine as much as possible, the head alone being protected from the direct rays of the sun. If the patient is being treated in the desert states where the sunshine is merciless, the patient must be exposed for short periods of time. The entire body can be exposed at one time if the duration is shortened, starting with an exposure of five or ten minutes and gradually increasing the time according to the individual's tolerance. In the East and North where exposure to the sun's rays is difficult because of climatic conditions and infrequent sunshine, dependence must be placed almost entirely upon artificial sunlight; particularly is this true during the winter months. Even where sunshine is available almost every day in the year, actinic rays from the quartz mercury-vapor lamps are splendid adjuvants, as they are of greater intensity and many of the rays are of shorter wave lengths and thus much more bactericidal than those coming from the sun. The



Pulmonary tuberculosis with cavity formation.

Plate LVIII

shortest wave lengths from the sun which reach the earth are 2900, while those coming from the quartz mercury-vapor lamps are below 2000 Angström units. The greatest bactericidal action lies between 3000 and 2000 Angström units. Again the rays from the lamps are available for instant use day or night under the best of conditions for the treatment of the sick.

In giving artificial light treatments in addition to all the sunshine the patient will tolerate, I use the visible light from the 1000-watt clear bulbs for an average of ten minutes, each surface treated, following this immediately with the actinic-ray treatments from the air-cooled quartz mercury-vapor lamp, starting at one minute for each surface treated, the distance being about thirty inches. These treatments are given daily until there is definite improvement (usually for the pulmonary case from 30 to 90 days), then three times a week for two or three months, then twice a week for several months. The total length of time these cases need treatment is from six to twelve months.

If there are local lesions, in addition to the above we give a short treatment with the water-cooled quartz-mercury lamp about 1 or 2 minutes at a distance of 1 or 2 inches.

For the less advanced cases, that is those without large cavities, I use the electric-light bath cabinet in the place of the 1000-watt clear bulb, because of the greater elimination during and after the treatment. I have the quartz-mercury tube installed in the cabinet and follow the visible light with the actinic rays as given above with this exception, that this part of the treatment is given in the cabinet while there is a complete hyperemia and I find it much more effective than when the treatment is given on a table, as all portions of the body except the head are exposed to all the rays. The patients for the cabinet treatment must be selected much more carefully than for the reclining treatments, as there is more depression due to the intense heat within the cabinet. For this same reason, the duration of the treatment must be shortened.

Tuberculosis of the Kidney.

Tuberculosis of the kidney may be primary or secondary, usually the latter, and must be considered a chronic disorder. There may be a single tubercular foci or the entire kidney may become involved with the perinephritic tissues.

The etiology is the tubercular bacilli, which is also its bacteriology, though mixed infections are common. The pathology is an early tubercular involvement of the papillae of the pyramids, the wall of the calyces and glomerular tufts, and the late involvement of the cortex and the perinephritic tissues. Secondary lesions in tubercular cases are usually the results of hematogenous distribution. A minor number of cases spread by direct contact

and by continuity. The kidney may be normal in size or it may be enormously enlarged as in hydronephrosis.

In general, the pathology is bacterial localization, tubercle formation, inflammation, caseation and with a mixed infection, pus formation, and if the bacteria are not destroyed, drainage and fistular tracts. In ulcerative cases the centrifugalized urine will yield tubercular bacilli which are best demonstrated by the inoculation of animals.

The cardinal symptoms are frequent urination, bloody urine, and discomfort in the region of the kidney and along the ureter. As the disease progresses, all symptoms become intensified and with perinephritic involvement very difficult of differentiation from other diseases affecting the abdominal cavity. There is progressive failure of health and emaciation, low grade fever, and a rapid pulse. A progressive secondary anemia is common.

Differential Diagnosis. Tuberculosis of the kidney must be differentiated from hydronephrosis, chronic nephritis both types, pyonephritis both bacterial and calculus types, hypernephroma, and the various malignancies. The final diagnosis lies in the results of inoculation.

The general management in these cases is the same as the general management of tuberculosis in general. Surgery is demanded for the cases with mixed infections and a nephrectomy when the case is far advanced. For the earlier conditions physiotherapy rightly deserves a fair trial. The medical care is the same as for tuberculosis in general. The physiotherapeutic treatment consists of general visible-light and actinic-ray treatments, with intensification over the region of the kidneys, which should not be limited to a single kidney. This intensification should be with the water-cooled lamp for about 1 minute at a distance of about 1 inch. If the intensification is with the air-cooled lamp, then the distance should be about 2 inches from the hood and the time increased to 3, 5 or more minutes.

The frequency of the general treatments should be daily until there is definite improvement and then less frequently.

The average length of time these patients require treatment is from a few weeks to months.

Diathermy through the kidney is valuable in the early stages, but should not be used in cases with mixed infection or incapsulated pus. In using diathermy, have the electrodes of composition metal 22 (B & S) gauge, in size about 4x5 inches. One electrode should be placed over the kidney posteriorly and the other anteriorly. Soap, lather, or moisture are not needed, but be sure there is perfect contact with the integument. The milliamperage will be about 1000 and the time of each treatment from 30 to 60 minutes. Give these treatments daily until there is definite relief and then less frequently.

Pott's Disease.

Pott's disease is considered under the head of bone tuberculosis. It is always of chronic type and its etiology is the infection of the vertebrae with tubercle bacilli.

The pathology is the gradual destruction of the vertebrae, usually starting in the cancellous tissue and spreading to the intervertebral cartilages. As these are destroyed it spreads to other vertebrae, or several may be primarily involved.

The destruction of the intervertebral cartilages differentiates it from the malignancy of the spine in which case the bodies of the vertebrae and not the intervertebral disks are the first to be destroyed. It must also be differentiated from arthritis, syphilis, and rickets.

There is no definite blood picture and the disease may be primary in the spine or secondary to pulmonary tuberculosis.

The cardinal symptoms of the acute exacerbation are pain, a slight rise of temperature, and myotonia. The pain and myotonia are increased by concussion.

The cardinal symptom of the advanced case, that is, after the vertebrae have commenced to break down, is of course deformity. Early symptoms are spinal distress rather than spinal pain. If the cartilages are involved early, there may be actual pain as one of the first symptoms which may be brought on by the position of the body which is fairly characteristic, being so placed as to avoid any jarring of the spine. If the child is watched when stooping, it will usually squat by flexure of ankles, knees, and hip joints rather than bend the spine, thus preventing discomfort or pain.

The general management of these cases will consist of the best hygiene possible, rest of the part during the active stage, with passive exercise of muscles to prevent atrophy. A liberal diet should be prescribed and one that contains a large amount of calcium, as milk and fresh vegetables. The bowels should be kept active but not loose. As the case improves, graduated exercise should be used in the effort to rebuild general health.

Surgery will be needed to prevent or correct deformities both by operation and casts. The principal drugs, regardless of the form in which they are used, are iodine, calcium, and phosphorus. Used internally, the iodide of lime in doses of $\frac{1}{2}$ grain three times a day, is one of the best. If the age of the child will permit, the intravenous use of sodium iodide, 32 grains, and guaiacol, $\frac{3}{4}$ of a grain, or calcium cacodylate in doses of 1 grain for the older children and proportionately smaller for the younger children will be of value.

Physiotherapy offers much for these conditions and can be used in a general way while the child is in splints or casts. The use here is for the general upbuilding of the individual, for the

increasing of the calcium salts within the blood stream and indirectly to the spine itself. Abscesses should be drained but not packed or curetted, and if it is possible to reach the site of the lesion, the water-cooled actinic-ray lamp should be used at a distance of about one-half inch for a period of about thirty seconds over the entire area. These local treatments should be preceded by a general visible-light and actinic-ray treatment and followed by the use of cod-liver oil by inunction, which is invaluable but must be used cautiously by mouth because of its liability to upset the stomach and interfere with digestion. Diathermy, if used at all, should be used with a great deal of caution in these cases, but at times it is of value.

The complication most likely to arise in these conditions is a mixed infection after the abscess is opened and following this pyemia or septicemia. The other complications are usually the deformities or paralysis due to compression or inflammation of the cord.

These cases require treatment for many months, and while the prognosis is usually good as to life, deformities are sure to occur and if untreated are very much more severe than in the treated cases. X-ray and radium have been found of use in tubercular lesions, but should be used with a great deal of caution in cases which have necrotic areas.

Case No. 13. Male, age 17. Was referred March 21, 1924, for treatment for an infection which was draining through four separate sinuses about the left groin and thigh. The infection had started fifteen months previously and had resisted bismuth paste and surgery. Some of the bismuth still remained in the psoas muscle as shown by the X-ray examination. The roentgenograms showed partial destruction of the third and fourth lumbar vertebrae, also erosions in acetabulum and about the head of the left femur.

His treatments were general visible light and actinic rays given daily with occasional doses of sodium iodide and guaiacol intravenously. In August, 1924, he fell, fracturing the left femur below the condyles; notwithstanding that this region was still draining we were able to get complete healing without open operation.

He remained eight months for treatment, at the end of which time he was in good general health; all but one sinus had closed and the drainage from this was serum probably due to the retained bismuth paste.

DIAGNOSIS: Tuberculosis of the Spine and left Femur.

Tuberculosis of the Testicle and Prostate.

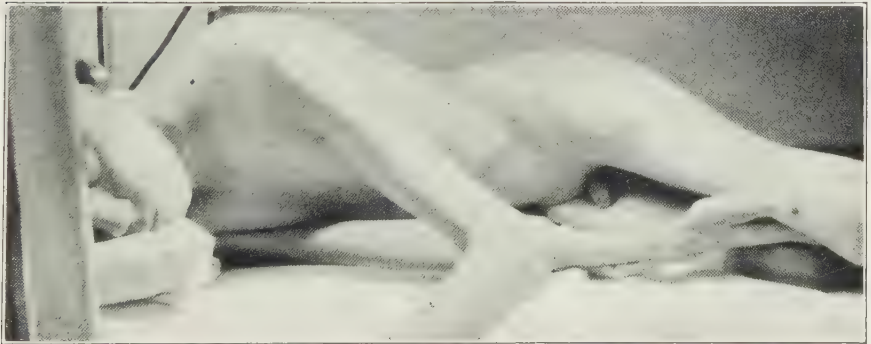
Tuberculosis of the prostate will cause a nodular hypertrophy and may cause abscess formation. It is usually secondary to tuberculosis of the epididymis, testicle, or bladder and is accom-



Tuberculosis of lower lumbar vertebrae with bismuth paste in psoas capsule.



Same case showing involvement of acetabulum and head of femur.



Characteristic position of patient.



Tabes mesenterica showing enlargement of upper abdomen.

Plate LX

panied by tuberculosis of the seminal vesicles and when palpated the vesicles will be felt as broad hard nodular bands running upwards and outwards from the prostate, and should not be confounded with syphilis and gonorrhea, which induce prostatic and orchitic hypertrophy, and must be differentiated from malignant disease of these organs. Teratomas of the testicle are fairly common. Carcinomas and sarcomas resemble the tubercular somewhat, except that the latter is usually more nodular and the tissues softer than in the malignant cases, which are usually stony hard. Acute epididymitis must be ruled out.

Tuberculosis of the prostate is best treated by the methods already given for the treatment of simple parenchymatous hypertrophy of the prostate and for prostatitis. The primary foci in the testicle and the surrounding tissues, including the inguinal lymph glands, should be rayed heavily with the water-cooled lamp and general visible-light and actinic-ray treatments should follow.

In these cases sodium iodide, 32 grains, and guaiacol, $\frac{3}{4}$ of a grain, will be found of extreme value as an adjuvant treatment; likewise calcium cacodylate and at times iron and nuclein for their stimulative effect.

Tubercular cases will require treatment from three to nine months or more and should be watched for several years for recurrences.

Tubercular Peritonitis.

Tubercular peritonitis may occur in the peritoneal covering of any of the abdominal organs. The fallopian tubes are among the first of the abdominal organs to show involvement. Usually this involvement is secondary to pulmonary tuberculosis. Primary involvement of the intestines or peritoneal covering in the abdomen is rare, while mesenteric lymph gland involvement is fairly common. Testicular involvement is usually primary, while that of the prostate is secondary.

The pathology is an inflamed peritoneum which may be localized, or the entire peritoneum may be involved. If the inflammation is localized, the abdomen may be free from adhesions, while if it is general, all of the intestines and abdominal organs may be massed together. The inflamed portion of the peritoneum will be thickened, edematous, and studded with tubercles from a millet seed in size (miliary type) to large masses resembling a carcinomatous growth from which it must be differentiated. The fact that peritoneal tuberculosis usually occurs in early adult life and carcinoma in middle or late adult life will help to differentiate them. The ascites of tuberculosis is usually a clear serum containing a predominance of lymphocytes, while that of carcinoma is brown or bloody. There may be an associated intestinal ulceration with bloody stools.

The symptomatology is indefinite, therefore it must be differentiated from chronic appendicitis, chronic enterocolitis, typhoid fever, and cirrhosis of the liver.

There are no cardinal symptoms, although a malaise followed by a slight fever (99.5° to 102° F.), a rapid pulse, emaciation, diarrhea, and indefinite symptoms referable to the abdominal cavity would lead one to suspect peritoneal tuberculosis, particularly so if there is tuberculosis in any other part of the body. The abdomen may be distended with fluid, or if emaciation is extreme and no ascites, there will be a retraction of the abdominal wall. The ascites may be free or encysted.

Frequently it will be necessary to do an exploratory laparotomy to clear up the diagnosis and even then the microscopic examination of a specimen may be needed for a final analysis. Discomfort is always complained of and at times there is very definite pain, although it may not be localized unless there is a localized peritonitis.

Treatment. The general management of these cases will be the general management of the primary tubercular lesion plus the peritoneal involvement. If the peritoneum is the site of the principal lesion despite its usual secondary involvement, surgery will be required either as an exploratory laparotomy or for the removal of a localized lesion. Many times, the simple opening of the peritoneal cavity is sufficient to clear up the peritoneal involvement if it is not too far advanced.

Regardless of what other treatment is given to the patient, it should be followed by general visible-light and actinic-ray treatments. If the case is not moribund when seen, or if there has been a laparotomy, or if the diagnosis can be made without an exploratory laparotomy, and if the ascites is not sufficient to cause dyspnea, the case may be started with general-light treatments. The ascites may be withdrawn by paracentesis, but this should be delayed as long as possible as the cavity refills rapidly after withdrawal.

Many times the phototherapy is all sufficient but if definite results are not obtained in less than ten treatments, the abdomen should be opened if the patient's physical condition will admit of this procedure, which can be done under gas or even a local anesthesia preceded by morphin and hyoscin hydrobromate.

Regardless of what else is done, these patients should be given all the sunshine they will stand, fresh air night and day, rest in bed if they are much enfeebled or are running a temperature above 100° F., good food, and extreme cleanliness. But every case should have phototherapy in addition to the above.

Tubercular Pharyngitis.

Case No. 534. Female, age 40. Came to me November 15, 1918. Eighteen months previously she had noticed that the ton-

sillar regions were very sore and interfered with the swallowing of solid food. The condition had grown worse despite medical treatment. When I first saw her the pharynx, pillars, and tonsils, as well as the nasopharynx, were covered with a gray membrane. The uvula had been eaten away, the pillars partially destroyed and there were three holes through the soft palate. There was a foci of involvement in the apex of the right lung. Several Wassermanns were taken but found negative.

Her treatments were general visible light and actinic rays daily for three months, then less frequently. These were followed by a local treatment to the throat and mouth with the water-cooled lamp for 1 to 10 minutes.

Improvement was steady from the first and in six weeks she was able to swallow solid food. She continued the treatments for nearly two years with complete healing of the throat and arrestment of the pulmonary lesion and is well at this writing, seven and one-half years after starting treatment.

DIAGNOSIS: Chronic Tubercular Pharyngitis.

Turbinates Hypertrophy.

Hypertrophy of the turbinates is a chronic inflammatory process of the nasal mucous membrane, particularly that part of it covering the turbinate bones. It may increase to the point of total obstruction of the nostril.

The cardinal symptom of nasal hypertrophy is obstruction more or less complete, but as this symptom may occur in a number of other diseases, they must be eliminated before a diagnosis is made. There is also an increase in the amount of secretion from the turbinates as the mucous membrane becomes inflamed and hypertrophied. The secretion may also be changed in character until it becomes thick, yellow, or mucopurulent. If there is even a partial obstruction of either nostril with a damming up of the secretion, bacteria will develop and an offensive odor will accompany the trouble.

Diagnosis should be made by visual examination through a suitable nasal speculum. In this way one can eliminate other tumor masses as neoplasms, polypi, exostoses, and erosions.

The principal etiological factor in this disease is continued or repeated attacks of acute rhinitis without proper treatment. Deformities aid in producing obstruction.

The treatment for this condition is either surgery or physiotherapy. In some instances it is necessary to remove the turbinates or a portion of them to insure free breathing. Either the non-vacuum nasal electrode with the Oudin current or actinic rays from the water-cooled lamp or both may be used. If the non-vacuum tube is used, it should be placed in the nostril before the current is turned on, then only the amount of current that is comfortable to the patient should be used, permitting the electrode to

slip backward as the treatment progresses. Use the current for five minutes in each nostril; seven minutes or more may blister. If inconvenient to turn on the current or if there is no foot switch, the current may be started before making contact, then the operator can place a finger on the electrode between the patient and the machine. This will draw off the current until it is properly placed. When using the water-cooled quartz-mercury lamp, use a solid quartz applicator for the intranasal application, thus preventing air absorption of the rays. If it is a simple hypertrophy, this is the best treatment for the condition as it shrinks the mucous membrane over the turbinates without any reactive dilatation such as follows the application of adrenalin or cocaine. The actinic-ray treatments increase the drainage and at the same time destroy any bacterial infection.

The length of time these cases will require treatment will depend upon the age of the individual, the general physical condition, and the amount of hypertrophy or coexisting diseases. Usually it will take from five to ten treatments given about twice a week.

The prognosis in these cases is good, but for deformities and exostoses, surgery must be used first and then followed by actinic rays for complete and permanent relief.

Case No. 162. Female, age 36. Was referred for treatment of hypertrophied turbinates April 15, 1922. Her general health was good and no other pathology discernible, so her only treatment was local application of actinic rays from the water-cooled lamp through a quartz rod to all turbinates. The treatments were given every third day and were of two minutes' duration in each nostril.

There was definite improvement after the third treatment. Twelve treatments were given with marked reduction in the size of the turbinates, giving adequate room for free breathing.

DIAGNOSIS: Hypertrophied Turbinates.

Traumatisms.

Traumatisms are always benefited by physiotherapy, which is of greatest value in the early hours following the injury. This, however, must be regulated by the location of the injury and the character of dressings or casts needed to care for the individual and the physiotherapeutic modalities at hand. Where heavy dressings, casts or splints must be used immediately, physiotherapy must be delayed until these can be removed, at least long enough for the physiotherapeutic treatment, when they may be reapplied.

Among the modalities useful for these conditions in the order given are visible light, actinic rays, diathermy, slow sinusoidal, heat, and massage. The visible light will help to reduce the immediate congestion and decrease both lymph and blood stasis, thereby

making the patient comfortable within a short time—say one-half to one hour. At this time actinic rays may be used only for their sterilizing effect, and with the heat from the visible lamp help to overcome shock. They also tend to raise both hemoglobin and the number of erythrocytes following hemorrhages and normalize the leucocytes.

If these methods cannot be used within a short time after the injury, they may be used at any subsequent period, but after two or three weeks their use, many times, can be made more practical if the lesion itself is not treated but the blood drawn from this region to other portions of the body which have not been damaged, thereby relieving pressure and pain at the same time.

After two or three weeks, diathermy will be of value in relieving blood and lymph stasis and will aid in the prevention of tissue fibrosis. Diathermy is more valuable at this time than later when the fibrosis has become fixed and produces a more or less permanent ankylosis, but it is extremely valuable at any stage.

The sinusoidal currents are of exceeding value both to prevent atrophy of the muscles and to restore atrophied muscles after injury, provided trophic centers are not destroyed at the time of injury.

Massage and hydrotherapy are of value in these cases, also passive and resistive manipulations.

The average length of time traumatic cases will require treatment will be from one or two treatments for mild lesions to several months for compound-comminuted fractures and other serious injuries.

The cardinal symptoms calling for treatment of traumatic cases are blood and lymph stasis, pain, and ankylosis.

The treatments should be given daily until there is definite relief of symptoms, then thrice or twice weekly, seldom less than this.

Urticaria.

Urticaria is a mild skin inflammation characterized by sudden attacks of itching and burning, followed by the appearance of wheals, particularly if irritated.

It has for its etiology a neurotic or a toxemic base which is usually due to the eating of foods which produce toxins and these may be almost any food product against which most people have immunity but some have an idiosyncrasy. Some drugs and many of the serums produce urticaria. These are known as anaphylactic reactions.

The pathology is a reflex vasomotor disturbance with rapid exudation of serum into the skin.

The general management of these cases, which is usually all that is required, is to clean out the alimentary tract from top to

bottom. Emetics may be useful if the stomach still contains food, otherwise cathartics such as castor oil, magnesium sulphate or citrate in sufficient quantities to produce free bowel movements will usually remove the trouble. However this does not apply to urticaria gigantea which usually has for its etiology an acidosis and requires a heavy alkalization for its treatment and this over a considerable period of time. This, however, will clear up most of these cases.

The average length of time that an acute urticaria will need treatment will be from a few hours to a day or two at most. In a few cases, weeks or even months may be required for complete relief.

The prognosis is good.

Varicose Ulcers.

Varicose veins are sacculations alternating with cicatricial contractions of the veins usually of the leg, but may occur in the broad ligaments, or the portal vein, or other veins within the pelvis or abdominal cavity. Only infrequently are they found in the upper extremities.

Long continued standing is the main etiological factor in the production of varicose veins. When moving about, the veins are alternately contracted and dilated by the action of the muscles. If one stands still for any length of time, the blood column tends to settle against the valves of the veins of the lower extremities, causing them to relax and finally weaken the vein wall, thus producing varicosis. Pressure within the pelvis from any cause, as pregnancy, fibrous, or other tumors are etiological factors.

The pathology, in addition to the thickened and tortuous vein, is the production of thrombosis and phlebitis and subsequent obliteration of the lumen. When this occurs, skin irritation and discoloration are liable to appear, followed by ulceration, the condition known as varicose ulcers. When the veins of the scrotum dilate, it is known as varicocele. With the blocking or obliteration of superficial veins there is more or less infiltration of the tissue by lymph. Infiltration differs from true edema of the lower extremities in that it does not pit under pressure, is of firm consistency, and is accompanied by discomfort, and many times by pain when standing.

In general these cases require the best hygiene possible and exercise rather than standing. Rest in bed is occasionally necessary where the ulcers are large and the patient is obese or the general vitality is low. Diet should be mainly of vegetables and fruit and the bowels should be kept free but not loose. Surgical treatment is often required for the excision of the veins or for their obliteration. Drugs have but very little effect either upon the varicosis or upon the ulceration. Occasionally aluminum acetate in a saturated solution as a wet dressing is an aid.

Physiotherapy offers much for these cases and actinic rays is the best physiotherapeutic measure. Visible light will help to relieve the veins by relieving blood and lymph stasis. The actinic rays destroy the infection and build up the vitality of the surrounding cells.

At times it is necessary to use diathermy for relief of the infiltrated tissue and when so used place one pad over the area of greatest infiltration, the other on the opposite side of the limb. If it is not possible to do this, one pad should be placed just below the knee, the other one the sole of the foot, or the foot placed in a dish of water, into which is placed the electrode, regulating the size of the electrodes to bring the greater portion of the heat into the desired area.

About the only complication worthy of note in these cases is hemorrhage, which may occur after ulceration takes place or from the bursting of a vein subcutaneously.

The length of time these cases will require treatment will depend upon the age of the individual, the size of the individual, the amount the individual must be on her or his feet, general hygienic surroundings of the patient, and whether or not there is associated diseases such as nephritis, diabetes mellitus, abdominal tumors, etc.

The average length of time these cases will require treatment will be from a few weeks to many months.

The prognosis is good.

Case No. 489. Female, age 52. Was referred for treatment November 23, 1924. She had an ulcer on the inner surface of the right tibia which was about three inches in diameter. It had started twelve years ago and had not been healed during this length of time. The surrounding skin was purple in color and adherent to the underlying tissues. The surrounding veins were enlarged and varicosed.

Her treatments were entirely with the water-cooled actinic-ray lamp, running from one to four minutes each, and were given twice a week. Seventeen treatments were necessary for complete healing.

DIAGNOSIS: Varicose Ulcers.

Vulvovaginitis.

Vulvovaginitis carries with it a great variety of infections.

The etiology may be anything from a simple infection due to the common pyogenic organisms to gonococci, Ducrey bacilli, spirochetes, tuberculosis, diphtheria, eczema, senile atrophy or hypertrophy, and fistula. Beyond this it will be necessary to include the malignancies, abscesses about the vaginal wall, urethra, rectum, or ischiorectal fossae.

The condition also has for its etiological factors cystic tumors, polypi, hernia, hematoma, foreign bodies particularly irritations

from pessaries, rectoceles, cystoceles, traumatisms, parasites, or pediculosis, and last, but not least, lack of cleanliness.

The vast majority of acute cases of vulvovaginitis are due to gonorrheal infection.

The pathology will depend entirely upon the etiology, but it may be anything from a simple herpetic inflammation of a vaginal mucous membrane, to the most advanced stages of carcinoma.

The symptoms of the acute variety are usually pain, throbbing in character; the color of the mucous membrane is from red to purple, with edema and increased dryness in the early stages, increased secretion at the latter stages. Whether or not there is painful urination accompanying this infection will depend upon the location of the inflammation. If the inflammation is in or about the vulva, there will be painful urination; if well up in the vagina there may be none unless the inflammation extends through into the bladder wall, then there will be pain not only during urination but all the time, which is increased when the bladder is empty.

Before starting treatment of any case of vulvovaginitis, a definite diagnosis must be made as the various etiological factors require various treatments. However, for the simple vaginitis, simple cleanliness is usually sufficient, together with the use of magnesium sulphate (saturated solution 25%) in glycerin, used either by injection or upon tampon. This must not be left in for more than four to six hours, when it should be removed and magnesium sulphate douches (one ounce to a quart of water) be used for cleansing purposes. These douches may be used two or three times a day, usually one is sufficient.

For the cases of gonorrheal vaginitis, if seen early, nothing equals the use of the silver salts or dyes plus the actinic rays from the water-cooled lamp thrown into the vagina through a vaginal speculum used in an upright position for the first minute and turned one-quarter for the second. If used as above stated, the rays will reach not only all portions of the vaginal wall but the cervix and urethra as well. If Skene's glands are also involved, they will require the same rays but a more intensive treatment, and many times cauterization will be required for the destruction of the glands as well as all of the bacteria. When the Bartholin glands are infected with gonococci, nothing but total extirpation will give permanent relief. Lancing or drainage relieves them for a few days or weeks only.

The etiological factor of chronic cases of vulvovaginitis will usually be found to be either continued uncleanliness or chronic gonorrhea. These cases will be treated similar to the acute cases except that they will require more treatment and a longer time for their eradication. Months and sometimes years will be required for the treatment of a tubercular vulvovaginitis. The ac-

tinic rays from the water-cooled lamp as a local treatment for one or two minutes with general visible light and actinic rays, are among the best treatments for these cases. Cod-liver oil can be used in tubercular cases both locally within the vagina and for skin inunction. It is best given by mouth provided the stomach is not deranged.

Eczema and pruritis accompanying vulvovaginitis usually yield to the same treatment given the vaginitis. In other words, they disappear automatically with the correction of the vaginal inflammation, their etiological factor.

Vaginal fistulae and tumors about the vagina and vulva must be removed, and rectoceles and cystoceles corrected surgically.

Malignancies are best treated by electrocoagulation and radium. Sarcomas are exceedingly rare in this location but must be remembered. Pessaries are seldom of any value in the correction of pelvic displacements and therefore should be relegated to the scrap heap. Where parasites are etiological factors in cases of vulvitis, particularly in children, these must be treated internally by the use of santonin in doses of 1/100 of a grain three times a day until the urine becomes yellow, or the use of enemas of sodium chloride or an infusion of quassia.

For *pediculosis*, shaving, using a heavy lather, and anointing the area freely with unguentum hydrargyri will usually be sufficient; however, some cases may be better treated by the use of tincture of larkspur applied to the involved area. Equal parts of kerosene and olive oil is an old remedy of value. The nits are best destroyed by shaving. Dilute acetic acid aids in their destruction.

Wounds.

Superficial wounds or traumatism of the skin is successfully treated by the use of actinic rays from the water-cooled lamp at a distance of one-half to one inch for one, two, or more minutes, to be followed by a dressing with a 10% solution of oleum terebinthinae in oleum olivae. The above treatment will care for most of these cases whether infected or not, including those in which a lymphangitis or phlebitis has already developed.

If this treatment is given soon after the injury occurs, it will heal by first intention, and the same applies to wounds made by intention for the relief of deep seated abscesses, as felons, bone abscesses, etc., after drainage is established. Daily treatment with actinic rays and the application of a ten to twenty per cent solution of oleum terebinthinae in oleum olivae will allow the dressings to be removed without traumatism to the granulating tissue. The olive oil is absorbed, thus furnishing a local food supply for the traumatized cell and lessening the irritation of the dressings applied over these wounds, thus giving immediate relief. As a rule, these dressings should be changed each twenty-four hours and the

treatment repeated. An exception should be made to this rule in cases where there are no symptoms of infection or inflammation and where the first pain symptom has disappeared. These cases heal by first intention and do not require subsequent treatments.

Xanthoma.

Xanthoma is a benign chronic neoplasm growing on various parts of the body.

Its etiology is not known.

It usually occurs in middle life and on females more than males.

The eyelids are favored locations.

Pathologically xanthomas are degenerative changes of the skin and muscle-fibers mingled with large amounts of fat substances.

Differentiation from other skin lesions is scarcely necessary as its chronic course and peculiar yellow color are sufficient to distinguish it from all other growths.

There are no subjective symptoms. The cardinal objective symptom is the yellow or orange-yellow tubercules or flat plaques from a pinhead to several inches in size. The larger areas are made up of a large number of small tubercules coalesced.

Treatment. The treatment is the complete removal of the spots by surgery, electrocoagulation, or radium. After complete removal, there is no tendency to recurrence although new spots may form on other portions of the body.

CHAPTER XVI

Questions and Answers.

1. What preparation should precede a light treatment?
Remove all clothing from the area to be treated. If the area is covered with crusts or discharges, they should be removed; dry sterile dressings are usually sufficient for redressing.
2. What are the dangers of destruction of normal tissues of the body with actinic rays from the carbon or quartz mercury-vapor lamps?
None, *except the epidermis*, if the time and distance specified are not exceeded.
3. Is the epidermis destroyed?
Yes, just as it is destroyed by sunlight.
4. What treatment is necessary for the inflamed or blistered epidermis?
The 2000-candlepower lamp, at 60 cm. distance, for twenty minutes or more, followed by the application of olive oil or petrolatum.
5. How often should the treatments be repeated for chronic diseases?
Daily until improvement begins and then less frequently.
6. How often should the treatments be repeated for acute diseases?
Daily.
7. How long are the treatments?
This depends somewhat upon what one is trying to do. In some cases only the slightest hyperemia is required, while in others a thorough blistering is needed to produce results. From one to ten minutes with the air-cooled or the water-cooled lamp for the early treatments; the later ones may be continued for from ten to twenty minutes.
8. What is the difference in time between treatments given with the air-cooled lamp and the water-cooled lamp?
Given at the same distance, there would be very little difference; but with the water-cooled lamp one can give the treatments in contact or under pressure, while with the air-cooled lamp one must keep the lamp at a distance of 20 or more centimeters to prevent heat burns.
9. How can one keep account of the time during the treatments?
Use an interval-timer.
10. Can all air-cooled actinic-ray lamps be used at the same distance from the patient and for the same length of time?
No, 110-volt lamps throw a smaller volume of actinic rays than the 220-volt lamps.

11. Can all water-cooled actinic-ray lamps be used at the same distance and for the same length of time?
The answer is the same as for question No. 10.
12. Is it necessary to protect the surrounding tissues for local treatments?
No, the tissues immediately surrounding the lesion should be rayed.
13. Should the same protection be used for malignant and non-malignant cases?
No, for the malignant, ray the surrounding tissues as well as the entire patient, not to destroy the malignancy but to build up the resistance of the patient.
14. How long will it take to produce a blister?
This depends largely upon the portion of the body being treated, the kind of lamp used, the distance of the lamp from the patient, and the susceptibility of the individual to actinic rays. Blonds blister more readily than brunettes. One-tenth of a minute with the water-cooled lamp in contact with the protected portions of the body will blister while three to five minutes will be required on the hands of one exposed to the weather. Two to five minutes will be required to produce a blister on the protected portions of the body with the air-cooled lamp at 60 cm. distance, while ten to fifteen minutes would be required to blister the hands at this same distance.
15. Do the actinic rays cause pain or discomfort during the treatment?
No; the patient does not feel anything during the ordinary treatment. The only exception to this is where the water-cooled lamp is used in contact for more than three minutes, when a burning sensation is experienced. This, however, is not due to heat but to irritation of terminal nerve filaments.
16. How soon after treatment does the patient experience discomfort?
Following heavy treatments, in from one to five hours; the reaction is at its height in from twelve to thirty-six hours.
17. How long does it take the patient to recover from the reaction?
From three to ten days. Very exceptional cases thirty days.
18. What about the reaction from subsequent rayings after the skin has become tanned by ten or more treatments?
It takes longer exposures and shorter distances to produce the same local reaction.
19. Is a heavy reaction ever desirable?
Yes, in some cases, and particularly for chronic local diseases as eczema or psoriasis.
20. Would it be desirable to produce a heavy reaction in chronic constitutional disorders?

Not as a rule, because such a reaction may produce chills, followed by a sharp rise in temperature, prostration, a general sense of illness, nausea, and perhaps vomiting, also a loss of will-power, from which it may take several days to recover. On the other hand, short treatments have a general tonic effect on the nervous system, producing increased appetite and strength, quiet, restful sleep, and general sense of well-being.

21. How is one to avoid a heavy reaction?
By starting the treatments cautiously; one minute with the air-cooled lamp at a distance of 60 cm. increasing the time one minute each subsequent day and decreasing the distance 3 cm. daily until improvement begins, or until ten-minute treatments are being given at a distance of 30 cm.
22. Is it ever necessary to go beyond the above time and distance?
Seldom, except for chronic local diseases such as malignancies, lupus, etc., when one blisters heavily with a water-cooled lamp.
23. How long may one use the water-cooled lamp in contact without doing damage to normal tissues?
The exact time has not been determined, but the author has given twenty minutes in contact—without a filter—without destruction below the epidermis. This was in a case where many treatments had been given. Five minutes or less are usually sufficient except in nevi when it may be necessary to increase the time to twenty minutes.
24. At what distance are the treatments given?
Usually start at about 60 cm. for the air-cooled lamp, decreasing the distance about 3 cm. daily as the skin becomes tanned, more slowly for blonds than for brunettes. Contact to 25 cm. for the water-cooled lamp.
25. What is the length of time required for treatments?
Usually one minute for the first treatment and increased one minute each day until the patient improves or until a period of ten minutes is reached.
26. What is the frequency of the treatments?
Daily until improvement is marked, then thrice, twice, or once weekly. Use physical methods of sufficient dosage and of sufficient frequency to start and keep the patient constantly improving as one would with drugs.
27. Over what period of time should treatments be given? For several treatments after the patient is apparently well.
28. Is it necessary for the operator to protect his eyes or hands while giving these treatments?
No, if he will keep out of the rays as much as possible.

29. What should be the position of the patient with regard to the lamp?
The rays must strike the surface of the body at right angles.
30. If only one of the two lamps could be purchased, which would be preferable?
This would depend upon the class of work being done. For general body treatments and constitutional disorders, the air-cooled lamp; for local or cavity treatments, the water-cooled lamp.
31. Why is the water-cooled lamp better for local or cavity treatments?
It is difficult to localize the air-cooled lamp, and when localized there is too much time consumed, as the length of the treatment must be in direct ratio to the distance of the patient from the lamp.
32. Is ischemia desirable in treating diseased conditions with actinic rays?
In a very few instances it may be; usually it is not.
33. In treating surface conditions which applicator should be used?
The one best suited to the lesion. This statement seems rather indefinite, but it contains the facts. If possible use the rays direct without any filter and without the solid-quartz applicators.
34. When should the solid-quartz applicators be used?
When the rays are to be intensified or the tissue compressed; otherwise seldom, though they may be used as a reducer and to prevent absorption of actinic rays by the air.
35. How should small areas be treated?
By cutting a hole in ZO adhesive plaster a trifle larger than the area to be treated and applying this to the skin.
36. When should the blue-quartz filters be used?
Seldom, if ever. We prefer the shorter, more intense treatments without them and believe we get better results.
37. Would it be advisable to have the air- and the water-cooled lamps on the same standard?
No, because they are clumsy and because one can just as easily use both at the same time, treating two cases instead of one.
38. What diseased conditions at times require blistering?
Malignant, tubercular (local lesions), eczema, naevi, acne, local sepsis, as abscesses, carbuncles, etc.
39. Can malignant diseases be cured with the actinic rays?
No, although splendid results have been obtained when they are used as a follow-up treatment for deep malignancies after removal of all extraneous growths by the cautery method of Dr. J. F. Percy, Los Angeles, California, or by the electro-

coagulation method of Dr. W. L. Clark, Philadelphia, Pennsylvania, or after destruction by X-ray or radium.

40. Can all diseases be treated with actinic rays?
No. See alphabetical list of diseases on page 437.
41. Will the mucous membranes stand as much raying as the skin? Usually no. In some instances they will.
42. How can cavities be treated with the water-cooled lamp?
By the use of ordinary specula or through special ones designed for particular purposes.
43. What is the frequency of the cavity treatments with the water-cooled lamp?
Usually every second or third day, but treatments may be given every day in special cases.
44. What is the length of time required for the treatment of mucous membranes?
From two minutes in the throat or nose up to five minutes in the vagina or rectum. They are usually given in contact, or nearly so, and may be given under compression except when tubular applicators are used then the distance will be the length of the applicator.
45. In giving local treatment should one give a general raying at the same time?
Yes, if the disease has produced any general symptoms and especially if metabolism is poor.
46. In giving a general raying how much of the body should be exposed?
Not less than the entire torso, and in many cases it is advisable to ray the limbs as well. Occasionally a heavy raying of the soles of the feet is decidedly beneficial.
47. What effect do the actinic rays have on the blood stream?
They increase the erythrocytes and hemoglobin and normalize the leucocytes.
48. How soon should results be expected in chronic cases?
Within ten days. In acute cases in a few hours, and, occasionally, in minutes.
49. Are the ultra-violet rays readily absorbed?
Yes; by everything except quartz, fluorspar, and water. Even a pocket handkerchief will absorb them.
50. Is glass or mica opaque to them?
Yes.
51. How can deeply placed diseased tissues be treated with actinic rays?
Deep tissues can be reached through the blood stream. Fin-
sen was the first to demonstrate that the blood stream absorbs
most of these rays, since which time many others have con-
firmed his statement.

52. Can the 2000-candlepower lamp and actinic rays be used simultaneously?
We think not, as they neutralize each other.
53. What will help to minimize the hyperemia following actinic-ray treatments?
The best method is to ray the area with the 1000-watt lamp at a distance of thirty or more inches for one-half hour or more.
54. What is the next best method?
Cover the surface with petrolatum or olive oil.
55. Will actinic rays cause permanent injury to the eyes?
No. Exceptions are cases of diabetes mellitus or where there are opacities.
56. Are the rays of use in treating cataracts?
No; they probably would be injurious. Radium is being tried apparently with success.
57. What temporary injury to the eyes will actinic rays cause?
A severe conjunctivitis.
58. What should be done for actinic-ray conjunctivitis?
Apply pure castor oil to the cornea and conjunctiva and keep the patient in a dark room until the irritation disappears.
59. How long will it take the patient to recover?
One to three days.
60. Can any harm come from long-continuance of actinic-ray treatments?
Not unless very heavy reactions are produced. We have given them daily for months with constant improvement. It is possible to do harm, but not probable.
61. What would be the effect on a person if he were to remain indefinitely under one of these lamps?
One person slept under the air-cooled lamp for one hour. She was badly burned and without will-power for about three days; otherwise she was in no way harmed.
62. How long will the skin remain tanned where treatment has been given for several months?
The disappearance is slower than when sun-tanned.
63. Will the actinic rays destroy in the same sense that the X-rays and radium destroy?
No; on the contrary, actinic rays from the quartz mercury-vapor lamp are constructive and beneficial in all cases of X-ray and radium dermatitis.
64. Will actinic rays benefit cutaneous and subcutaneous tissues damaged by X-rays or radium?
Yes. Badly burned cases may need electrocoagulation first.
65. How should the scars from X-ray dermatitis and the telangiectasis following be treated?
Blister thoroughly and repeat as soon as the epidermis exfoliates.

66. Should one explain to patients that a hyperemia may be produced?
Yes, by all means; otherwise they will become unduly alarmed when the hyperemia begins.
67. Can actinic rays from the air-cooled lamp be thrown into cavities?
Yes, but the technique is much more difficult and the results not so good as with the water-cooled lamp.
68. What substances will actinic rays fluoresce?
Protoplasmic cells, willemite, and many other substances.
69. Have the actinic rays an affinity for oxygen?
They have, and herein lies much of their value.
70. Will actinic rays penetrate living tissue?
Yes; for short distances, 4.65 millimeters when the tissue is rendered ischemic.
71. How should a general treatment be given?
First, ray torso front and back with a 1000-watt lamp for ten minutes, following this with the actinic rays from the air-cooled lamp.
72. For what purposes is the 1000-watt lamp used?
To dilate the capillaries and bring the blood to the surface thus relieving blood and lymph stasis and deep congestions.
73. Will the 1000-watt visible lamp produce ultra-violet rays?
No. They will not penetrate glass in any appreciable quantity.
74. Can actinic rays be used for coryza?
Yes, in conjunction with visible light. Use a solid quartz rod applicator in each nostril for two minute.
75. How should a case of gastric ulcer be treated?
By giving a twenty-minute treatment with the visible light, followed by actinic rays, using the air-cooled lamp at a distance of 60 cm. for three minutes, gradually reducing the distance and lengthening the time up to ten or fifteen minutes. (See case report.)
76. Will the actinic rays lower blood pressure?
Yes, as the general condition of the patient improves, although we seldom depend upon the rays alone, but use them in conjunction with autocondensation for the high blood pressure of chronic nephritis.
77. Will the rays help insomnia?
Yes.
78. Will these rays benefit neurasthenic conditions?
Yes.
79. What results may be expected in Pott's disease?
Good. The best single method we possess but use everything else of value in conjunction with this treatment.
80. How can a prostate gland be rayed?
Through a proctoscope.

81. How should a posterior urethritis be treated?
Through a proctoscope.
82. How should a case of cystitis be treated?
Through the vagina or rectum and over the pubes.
83. Will actinic rays increase elimination?
Yes. Urinary analyses show that the quantity of uric acid and creatinin eliminated is increased (200 and 76 per cent, respectively).
84. Will actinic rays help tuberculosis in all forms?
Yes; they are the best single remedy we have, when used with other recognized methods, such as sunlight, good food, fresh air, hydrotherapy, heliotherapy, etc. Rest is not so important an adjunct (except in high temperatures), and the patient will usually be better off if permitted to occupy his mind and exercise his muscles to a limited extent.
85. Will actinic rays increase the tubercular temperature?
Not if used cautiously. Heavy raying will produce a temperature in any patient.
86. How should actinic rays be used in treating a case of pulmonary tuberculosis?
Begin by raying the torso for ten minutes each surface with a 1000-watt visible lamp, followed by a one-minute treatment with the air-cooled lamp at a distance of 60 cm. Treat daily until there has been decided improvement, then twice or thrice weekly. Increase the time one minute each treatment until a period of ten minutes is reached, and meanwhile reduce the distance 3 cm. daily until 30 cm. are reached. Bone, gland, and peritoneal tuberculosis are similarly treated except that we use the water-cooled lamp locally as well.
87. Will the actinic-ray treatments improve tubercular joints that are fixed or nearly so?
Yes, following the relief of pain and swelling comes improved joint movement which may be aided by the use of diathermy.
88. Is this not contrary to surgical treatment were ankylosis is the thing desired?
Yes, and in most cases actinic rays alone are better than surgery alone. Use both.
89. How should a tubercular larynx be treated?
Principally from the outside. Cross-fire the larynx and give general body treatments, also use a solid quartz laryngeal applicator and the water-cooled lamp for two minutes.
90. How should a tubercular throat be treated?
Through the mouth and by general treatments.
91. How would you treat eczema?
Blister it; meanwhile remove the etiological factor if possible.
92. Will actinic rays cure blepharitis and infective conjunctivitis?
They are decidedly beneficial but must be used with caution.

93. Are the actinic rays of use in cases of high blood-pressure, especially when accompanied by nephritis?
Yes, one of the best methods. Give general body raying, and in conjunction we use autocondensation for ten minutes, using a thick pad and about 600 ma.
94. Are actinic rays soothing?
Yes, if not sufficient to blister. Patients will frequently go to sleep while taking their treatments.
95. Are violet and ultra-violet rays the same?
No. What are commonly called violet rays are produced by a high-frequency current and a vacuum tube, the color depending upon the degree of vacuity. Ultra-violet indicates invisible rays located just below the violet in the spectrum, while the ultra-ultra violet are still further removed from violet and are known as the Schumann band of the spectrum.
96. Are actinic and ultra-violet rays the same?
Yes and no. Actinic rays are chemical rays and to some extent are developed in the visible and infra-red regions of the spectrum although the greater number are produced in the ultra-violet region and on down the scale to radium gamma rays at 0.07 of one Angström unit. The actinic rays here referred to are found the spectrum from 5000 to 2000 Angström units, round numbers.
97. Are the sun's rays and actinic rays the same?
No, the sun gives all the rays of the visible spectrum, including some infra-red and ultra-violet down to 2900 Angström units. The quartz lamps give rays from 5000 to 1860 Angström units.
98. Will the air-cooled lamp produce ozone in sufficient quantity to be remedial?
Probably so, but proof is not available, however it is not detrimental.
99. If a patient should discontinue taking actinic-ray treatments for more than two weeks, could treatments be resumed for the same period of time of the former treatments?
No; the treatments must be started as with a new case.
100. *Start your cases cautiously. Treat them boldly.*

TABLE OF DISEASES

Glossary.

"A.C.L." means "air-cooled lamp."

"W.C.L." means "water-cooled lamp."

"Time" is given in minutes.

"Distance" gives the number of inches the lamp should be from the patient.

Frequency: "D" means "daily."

"W" means "weekly."

"2/W" means "twice weekly."

"3/W" means "thrice weekly."

"Visible light" means a 1000-watt lamp. The distance of the lamp from the patient is not given as it varies with each patient and should be just far enough away to be comfortable. If too close it produces a nervous irritability. Where visible light is used it should precede the actinic-ray treatment.

"Remarks" are self-explanatory.

"L" means "local."

"G" means "general" or body treatment.

"C" means "contact."

"Spec." means "speculum."

When both actinic-ray lamps are quoted for one disease, either may be used or the water-cooled lamp for local treatment and the air-cooled lamp for general treatment of the same case.

In the following table the author has endeavored to give the maximum and minimum of time, distance and frequency for each lamp and for each separate disease. This table is intended for a guide; experience alone will teach you the exact amount needed.

Beneath the line devoted to phototherapy will be found mention of other physical-therapy measures found useful. Description of these will be found in their respective chapters.

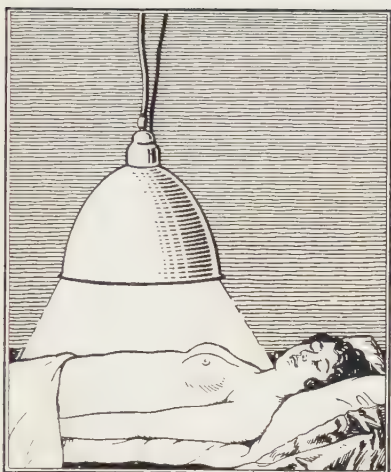
General Treatments.

To avoid constant repetition with each disease, visible light and actinic-ray treatments have been given as general treatments and when so designated mean visible light for not less than ten minutes each surface treated to be followed by actinic rays from the air-cooled lamp for one to ten minutes each surface treated. We start the first treatment at one minute and usually increase about one minute each subsequent treatment until ten minutes are reached, seldom exceeding this time.

The distance of the visible light from the patient is such that it is comfortable. The distance of the air-cooled lamp is about 60 cm. for the first treatment gradually decreasing the distance to about 35 cm. by the tenth treatment.

The frequency is daily until there is definite improvement, then less frequently.

Actinic rays are auxiliary to all other recognized methods of treatment, although in many cases they alone are sufficient.



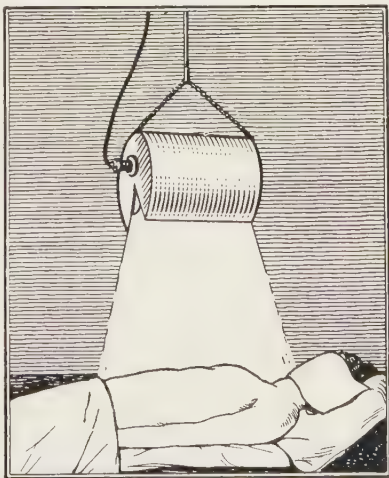
First position of patient for general treatment with visible light.



Second position. Note distance of lamp from patient.



Third position of general treatment showing first part of actinic radiation.



Fourth position of general treatment and second part of actinic radiation.

CHAPTER XVII.

Physical-Therapy Technique Condensed.

Disease	Visible Light Minutes	Time Minutes	Actinic Rays Dist. WCL Inches	Pre- quency	Remarks
Abscess	10	1-10	30-5	1-C	Drain first. L. & G.
After drainage diathermy may be used cautiously.					
Abscess (apical)	10	1-10	1/4-1	30-15	1-C
Acne	20	2-10	1/4-2	30-10	2-1
Roentgen rays may be used but only with extreme caution.					
Infra-red frequencies are at times of value for increasing the hyperemia.					
Adenoma	20	2-20	1/2-5	30-10	1-C
Adenoma of the breast should be removed surgically because of the liability to become carcinomatous. Examine specimen microscopically. Radium introduced into the tumor is, many times, sufficient especially in thyroid, prostate, etc.					
Adenitis (T. B.)	20	2-10	1/2-3	30-5	2-C
Lance necrotic glands. Radium or X-ray is at times of value, especially before necrosis occurs. They can be alternated with phototherapy.					
Adhesions (all kinds)	20	1/2-5	.....	30-10	....
Diathermy is of great value particularly so for adhesions of the abdomen or thoracic cavities and fibrous ankylosed joints.					
Alopecia (areata) (senilis)	...	3-10	1/2-5	10	2
Where matrix is destroyed, phototherapy is of no value.					
Alcoholism	20	1/2-5	.....	30-15	....
Fasting with free elimination is best. Strychnin nitrate hypodermically 1/60 to 1/20 of a grain t.i.d.					
Amenorrhea	30	1/2-5	.....	30-15	....
Use concussion or vibration over 2nd and 3rd dorsal vertebrae. Usually occurs with hypothyroidism.					
Anal Fissures	.....	1/2-3	.....	C	2/W
Electrocoagulation or desiccation under local anesthesia to be followed by heavy ultra-violet radiation.					
Anemia (secondary)	10	1/2-10	.....	30-15	....
The etiological factors must first be corrected if at all possible. Diathermy through the spleen and liver is of value.					
Angioma	.....	1-10	.....	C	W
Use the water-cooled lamp for superficial angiomas only. Use radium or high-frequency currents or surgery for deep angiomas or those with laking. This is to be followed by heavy ultra-violet radiations.					

Disease	Visible Light Minutes	Time ACL	Minutes WCL	Actinic Rays Dist. ACL	Inches WCL	Fre- quency	Remarks
Burns (X-ray or radium)	.20	1½-3	1½-1	30-15	2	D	Blister. L. & G. If deep scar remains or there is keratosis, use desiccation first. If the subcutaneous tissues are ulcerated, use electrocoagulation.
Bunions	.....	1½-5	1¼-3	20-10	1-C	2/W	Blister lightly. L.
If large with new bone formation, remove surgically.							
Bursitis	.....	20	1½-10	1¼-5	30-15	2-C	D Blister. L.
Diathermy is of decided value and is many times alone sufficient.							
Bubo	.....	20	1½-5	1¼-3	30-15	1-C	D Blister lightly. L.
Lance if pus has formed, then use the water-cooled lamp which is usually all that is necessary.							
Carbuncle	.....	20	1½-10	1¼-5	20-10	2-1	D Have free drainage. L.
When widespread, use electrocoagulation first, then phototherapy.							
Carcinoma	.....	20	1½-10	1¼-5	20-10	2-C	D As adjuvant. L. & G.
Where it is possible use cauterization, electrocoagulation, or desiccation first. For deep-seated lesions use surgery preceded and followed by radium or X-ray. For the superficial lesions, use desiccation or electrocoagulation. Use physiotherapeutic methods to increase metabolism.							
Caruncle							
Use radium or electrodesiccation for their complete destruction.							
Catarrh (nasal)	.....	.....	.....	.....	.....	.....	See Hypertrophied Turbinates.
Cavernositis (fibrous)	.....	.....	.....	.....	.....	.....	.....
Radium most valuable. Diathermy is useful at times.							
Cervicitis	.....	1-5	1½-2	5	Spec. 3/W	L.	
If of gonorrheal etiology, use intense heat, usually Percy cautery.							
Cellulitis (pelvic)	.....	30	3	1-2	Spec. D-3/W		Drain abscess. L. & G.
Infra-red rays. Continuous douches at a temperature of 120° F.							
Cellulitis (surface)	.....	30	2-10	1½-3	20-10	1	D Drain abscess. L. & G.
Visible light may be used continuously.							
Chancroid	.....	.....	2-5	.....	1	D	Will not cure chancre. L.
Desiccation is at times needed for indolent cases.							
Chilblains	.....	.....	1½-5	1¼-2	20-10	1-C	D Produce erythema. L.
Magnesium sulphate saturated solution as a wet dressing gives quick relief.							
Chlorosis	.....	20	1½-5	.....	30-15	....	D Persistence means success. G.
Iron is exceedingly valuable.							

Disease	Visible Light Minutes	Time ACL	Minutes WCL	Actinic Rays Dist. ACL	Inches WCL	Fro- quency	Remarks
Ductless-gland dysfunctions	.20	2-10		20-10		D-2/W G.	
Continue for several months as an aid to metabolism.							
Duodenal ulcer	.20	1-15	1-5	20-10	C	D	Non-protein diet. L. & G.
In chronic cases, diathermy may be used as an adjuvant.							
Dysmenorrhea	.30	2-10		20-10		D	Four days before period. G.
Diathermy may be used, also infra-red rays.							
Dyspepsia	.20	1-10		20-10		D	See Gastritis. More attention to diagnosis.
Dysentery	.30	1-15		20-8		D	Blister lightly. G.
Echymosis	.45					L.	
Use constant massage while using the visible light. Mild vibration using a soft vibrator will aid in the removal of the blood.							
Eczema (all varieties)	.20	5-10	1-5	16-8	5-1	3/W	Correct diet. No aqueous ap-plications. L. & G.
Empyema	.30	1-15		20-10		D	Drain if necessary. G.
After drainage, diathermy may be used mildly, 300 to 500 milliamperes. For adhesions, which may follow empyema, diathermy is the best treatment.							
Endocarditis	.10	1-10		30-15		D-3/W G.	
Diathermy is of value in heart infections, but must be used cautiously and at low milliamperages, 200 to 500 ma.							
Enterocolitis							See Colitis. G.
Enuresis	.20	1-10		20-10		D	Ray heavily but short of blis-tering. G.
Surgery is frequently needed; study the etiology.							
Epididymitis	.20	1-10	1-3	30-15	1-C	D	L. & G.
Do not blister the body. Locally, blistering is many times of definite value. Diathermy is of value but not equal to actinic rays.							
Epithelioma	.10	1-10	1-2	30-15	1-C	D-2/W	L. & G.
Phototherapy is used for its metabolic effect only. Where they can be readily used, electrodesiccation or electrocoagulation followed by radium, or X-ray, and actinic rays from the water-cooled lamp for their anti-septic and stimulating effects.							

Disease	Visible Light Minutes	Time ACL	Minutes WCL	Actinic Rays Dist. ACL	Inches WCL	Fre- quency	Remarks
Leukemia, lymphoid							
Same as above, except that the lymph glands should receive the heaviest raying.							
Leukoplakia			1/4-1	.....	2	1/W	After radium. L.
Radium packs are the ideal treatment for these cases.							
Leucorrhea		2-8	1-3	Spec.	Spec.	3/W	Make proper diagnosis. L.
Treat the underlying etiology.							
Diathermy is at times beneficial.							
Lichen simp.		2-10	1/4-3	20-10	2	3/W	Blister slightly. L. & G.
Lichen planus		2-10	1/2-3	15-5	2	3/W	Blister slightly. L. & G.
Lumbago		30	1/2-5	1/4-1	10-5	1 D	Produce erythema. L. & G.
The visible light for thirty minutes followed by five minutes of vibration is usually sufficient to stop the pain.							
Lupus ery. or vulg.		2-10	1-5	10-5	1	2/W	Blister heavily. L. & G.
Often it is beneficial to desiccate margin first with the Oudin current.							
Lymphangitis		1-10	1/2-3	10-2	2	2/D	Rapid results are necessary. L. & G.
Lymphadenitis		30	1-10	1/2-3	20-10	1 D-3/W	Lance abscess. L. & G.
Marasmus		20	1/2-10	.....	30-15	 3/W	For stimulation of metabolism. G.
Myositis		30	1/2-10	1-3	20-10	1-2 D	L. & G
Diathermy is of value.							
Naevi (all kinds)			1-10	.....	C	W	Blister heavily. L.
In laking cases, it may be necessary to use surgery, electrocoagulation, radium, or X-ray.							
Neisserian							See Gonorrhea. L. & G.
Nephritis		20	1-10	.....	20-10	 D	Avoid blistering. G.
Phototherapy in the bath cabinet is the most valuable.							Use autocondensation for hypertension.
Neuralgia		30	1-15	1-5	20-6	1-C D-3/W	Give heavy local treatments. L. & G.
Diathermy and infra-red rays are valuable.							
Neurasthenia		20	1-10	.....	20-10	 D	Do not blister. G.
Use phototherapy or heliotherapy for their sedative effect.							

Physical-Therapy Technique Condensed.

Disease	Visible Light Minutes	Time ACL	Minutes WCL	Actinic Rays Dist. ACL	Inches WCL	Fre- quency	Remarks
Neuritis	20	1-10	1-5	15-2	2-C	D	Blister if need be. L. & G.
Diathermy and infra-red rays are of value.							
Onychia	15	1-10	1-5	10-5	1½-C	D-3/W	Blister slightly. L.
Remove nail if necessary.							
Orethritis	20	.....	1-5	.....	1-C	D	Support scrotum. L.
Diathermy is at times of value.							
Osteitis	20	1-15	1-3	30-15	2	D	L. & G.
Osteomalacia	10	1-15	.....	30-15	.....	D-3/W	G.
Osteomyelitis	30	1-15	1-5	20-6	2-C	D	After drainage. L. & G.
Diathermy valuable to increase deep circulation.							
Ovaritis	20	1-10	2-5	20-10	Spec.	D-3/W	Mag. sul. tampons. L. & G.
Ozena .....	.....	.....	1-4	.....	1-C	D-3/W	After scabs are removed. L.
Very light desiccation or non-vacuum tubes used on the Oudin current should precede the ultra-violet treatment.							
Pancreatitis	30	1-5	.....	20-10	.....	D	Heavy treatments. G.
Use diathermy through the pancreas.							
Pelvic cellulitis .....	.....	.....	.....	.....	.....	.....	See cellulitis.
Positive galvanism using a copper-ball electrode in the vagina is of definite value; so is diathermy.							
Periostitis	10	5-10	1-5	10-2	1-C	D	Open abscess. L. & G.
Radium for ten to thirty minutes is of value for stimulation.							
Pernio .....	.....	.....	.....	.....	.....	.....	See Chilblains.
Pharyngitis .....	.....	1-5	1-3	6	1	D	Through mouth. L.
Phlebitis	30	1-10	1-3	20-10	3-1	D	Elevate limb. L. & G.
Phlegmasia alba dolens.....	30	1-10	.....	24-10	.....	D	Avoid blistering. G.
For the acute condition, magnesium sulphate solution as a wet dressing is valuable. For the chronic condition diathermy is at times of value.							
Pityriasis (all varieties)	10	1-10	1-3	24-14	2	3/W	Blister lightly. L. & G.
Pleuritis	30	1-10	.....	30-15	.....	D-3/W	G.
Diathermy is at times of value.							

Disease	Visible Light Minutes	Time ACL	Minutes WCL	Actinic Rays Dist. ACL	Inches WCL	Fre- quency	Remarks
Pleurodynia	30	1-10	.....	30-15	....	D-3/W	G.
Pneumonia (unresolved)....	30	1-10	.....	30-15	....	D-3/W	G.
Diathermy is of definite value.							
Poliomyelitis	30	1-10	.....	30-20	....	D	For acute cases. G.
Slow sinusoidal or superimposed wave after three weeks.							
Pott's Disease	30	1-20	1-2	20-10	4-C	D-1/W	Surgery if necessary. L. & G.
Proctitis	.....	.....	1-3	.....	Spec.	D-2/W	Use massage. L.
Diathermy is valuable when given with rectal applicator.							See Prostatitis. L.
Prostatic hyper.	.....	.....	.....	.....	....		
Surgery, radium, and X-ray are to be considered.							
Pruritis ani.....	.....	.....	1/4-3	.....	2	3/W	Study etiology. L. & G.
Many times it is necessary to treat a proctitis, vaginitis, or endocervicitis at the same time.							General treatments for etiology. L. & G.
Pruritis vulvae	.....	.....	1/4-3	.....	2	3/W	
See Pruritis ani.							
Psoriasis	20	2-10	1 1/2-3	10-5	2	D-2/W	Blister. L. & G.
Sea plasma and sodium salicylate are of value.							
Pyonephrosis	30	1 1/2-8	.....	20-10	....	D-2/W	Surgery if indicated. G.
Diathermy is of value. Use large pad over the kidney.							
Pyosalpinx	30	1 1/2-8	2-5	20-10	Spec.	D-2/W	Surgery if indicated. L. & G.
Diathermy useful after drainage.							
Rachitis	30-60	1-10	.....	30-15	....	D-3/W	Keep child in the sunshine. G.
Raynaud's disease	60	1-10	.....	60-30	....	D-2/W	Use greater distance. Do not blister. G.
Rheumatism	30	1-8	1/4-3	20-10	2	D	Study etiology. G.
Diathermy is often valuable; also infra-red frequencies.							Cabinet baths are par excellence.
Rheumatism (gonorrheal) .45	1/2-10	1/4-3	10-5	2	D		L. & G.
Diathermy is ideal, both for diagnosis and treatment.							
Rhinitis (atrophic).....20	.....	2-4	.....	1-C	3/W		Through nose. L.
Non-vacuum tube on Oudin current of definite value.							

Physical-Therapy Technique Condensed.

Disease	Visible Light Minutes	Time ACL	Actinic Rays Dist. ACL	Inches WCL	Fre- quency	Remarks
Rhinitis hyper.	20	.....	.....	.....	3/W	Through nose. L.
Always use a solid quartz applicator.						
Rhinophyma	.....	.....	.....	.....	2/W	In necessary in bad cases. Blister heavily. L.
Radium extremely valuable.						
Rhinoscleroma	20	1-8	.....	.....	2/W	Blister heavily. L.
Radium is of definite value. It is most effectively administered by using the needles in the tissue.						
Rosacea	20	1-8	.....	.....	2/W	Blister heavily. L.
Salpingitis	30	1½-8	.....	.....	Spec. D-2/W	Surgery if indicated. L. & G.
Positive galvanism using a copper-ball electrode in the vagina relieves the pain very quickly. Diathermy likewise is of value.						
Sarcoma	20	1-10	.....	.....	D	L. & G.
First use surgery, electrocoagulation, radium, or X-ray, then phototherapy for its effect on metabolism only.						
Scar Tissue	.....	.....	.....	.....	.....	See Cicatrix.
Sciatica	30	1½-5	.....	.....	3/W	Study etiology. L. & G.
Diathermy and infra-red frequencies are helpful.						
Scurvy	30	1-10	.....	.....	D	Use vitamin C. G.
Scrofulosis (T.B.)	.....	.....	.....	.....	.....	See Adenitis. L.
Seborrhea	20	1-5	.....	.....	3/W	Blister. L.
Septicemia	30	1-10	.....	.....	D-3/W	After drainage. L. & G.
The longer the phototherapy treatment the better. The distance must be increased accordingly.						
Sigmoiditis	.....	.....	.....	.....	.....	See colitis. L.
Sinus Infection	45	1-10	.....	.....	D	Maintain drainage. L. & G.
Non-vacuum nasal electrode of value.						
Sycosis	.....	5-15	.....	.....	3/W	Clip hair. L.
Synovitis	.....	1-10	.....	.....	D-W	Persist. L.
Diathermy valuable when given through the joint.						
Syphilis	.....	.....	.....	.....	.....	Only a slight aid. L. & G.
Tabes Mesenterica	60	1-10	.....	.....	D-3/W	Open abscess. G.

CHAPTER XVIII.

Simplified Physical Therapy.

Heliotherapy includes all the wave lengths from the sun.

Phototherapy includes all wave lengths both from the sun and those artificially produced. This includes infra-red, visible, and ultra-violet.

Actinotherapy covers all chemical wave lengths principally between 6000 and 2000 Angström units.

High-frequency currents are Oudin, Tesla, and d'Arsonval by name.

The Oudin is a unipolar, high-voltage, low-amperage current.

The d'Arsonval is a bipolar, low-voltage, high-amperage current.

High-frequency means very rapid oscillations. From the medical standpoint from a half to three million per second.

Diathermy, both medical and surgical, is plain heat and is due to the very long infra-red wave lengths. Diathermy has no polarity.

A rapid sinusoidal current is one of comparatively slow oscillations, around 3000 per minute, while a slow sinusoidal is the same current oscillating from 10 to 100 times per minute.

The superimposed wave current is the rapid sinusoidal current running at the same time as the slow sinusoidal. The sinusoidal currents do not have polarity.

The surging sinusoidal current gives a stronger muscle contraction than the superimposed wave.

The galvanic (direct) current is a unidirectional current having a polarity effect. The positive pole is acid, the negative is alkaline. See page 39.

The surging galvanic current is unidirectional and has polarity effects. This current has a surge which imitates somewhat the muscle contraction of the sinusoidal current, but remember it has polarity which is at times desirable.

The interrupted galvanic current gives the greatest nerve impulse and is also the most painful.

Vibration is a mechanical massage.

Massage is a manipulation of soft tissues.

Hydrotherapy is the use of water in any form.

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